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ABSTRACT

This manual provides information concerning the basic skills needed to perform the tasks of the occupation of entry-level welder. It is intended for vocational program directors and administrators, vocational counselors, vocational instructors, basic skills instructors, and curriculum developers. An introduction reviews the study to link basic skills to occupational tasks and welding training, defines terminology, describes the methodology, and suggests uses for the study. A narrative summary of the welder basic skills data and of the frequency of performance data associated with occupational tasks is contained in section 2. Section 3 is a welder occupational task list. In the final section, welder tasks are presented by individual basic skills area: job-related listening and speaking, job-related mathematics, job-related reading, and job-related writing. Discussion of each skill area contains the following elements: related terminology, a taxonomy that takes a job-related approach to the basic skills and expresses them in performance terms, discussion of the data regarding the basic skills required for task performance, linking of tasks to specific applications of the basic skill, and a list of occupationally specific instructional materials for teaching the job-related basic skill. Appendixes include the survey form. (YLB)

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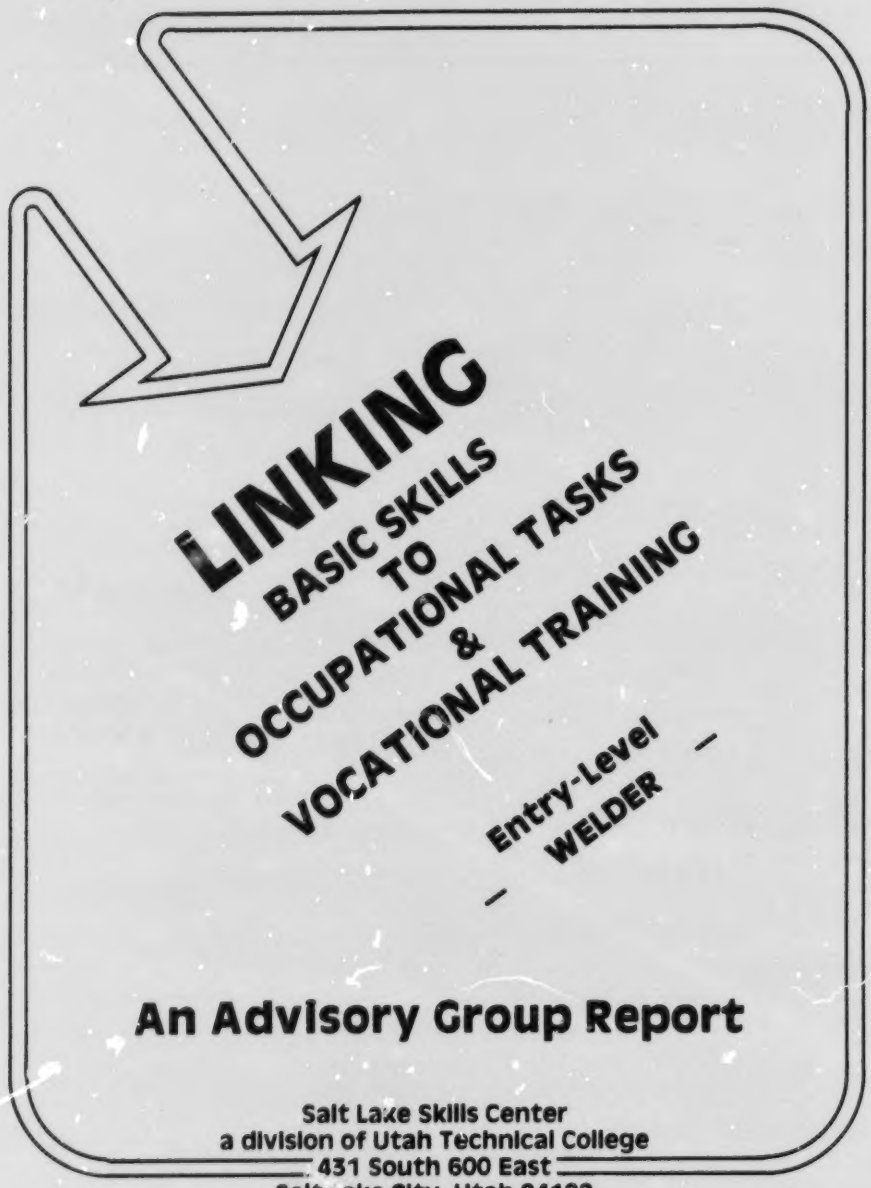

# LINKING
## BASIC SKILLS TO OCCUPATIONAL TASKS & VOCATIONAL TRAINING

### Entry-Level WELDER

## An Advisory Group Report

Salt Lake Skills Center
a division of Utah Technical College
431 South 600 East
Salt Lake City, Utah 84102
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# Section I
# Introduction

## Study Overview

This project was undertaken in response to a need expressed by vocational administrators and educators for more detailed information concerning the basic skills needed to perform occupational tasks. The occupation of entry-level welder was studied in this report.

The information compiled in this manual is intended for the following audience:

Vocational Program Directors and Administrators
Vocational Counselors
Vocational Instructors
Basic Skills Instructors
Curricula Developers

An advisory group consisting of welding supervisors, welding instructors, and basic skills instructors was asked to determine the specific basic skills needed to perform each welder task. Participants from industry represented small, medium and large companies.

Data collected at this meeting provides the basis for drawing some preliminary conclusions since the purpose of the advisory group was to gather "experienced opinion" rather than to conduct formal or extensive research.

### Implications for Training

The data gathered in this study may be helpful in forming some decisions concerning the basic skills which appear to be most important for students in welding training programs.

Training which links vocational skills to basic skills could be organized to meet the educational needs of individual students. For example, if a student is unable to meet the math requirements of shielded metal arc welding, he/she could begin the training program by learning acetylene or gas metal arc welding tasks because the occupational tasks in these areas appear to require fewer math tasks. Meanwhile, the student could be building upon his/her math proficiencies to prepare for duty areas which require more math.

Vocational training could be partially tailored to the individual student's strengths and weaknesses in the basic skills.

## Terminology

| | |
|---|---|
| Basic skills: (occupationally oriented) | Essential reading, math writing, listening and speaking skills needed to secure and maintain employment. |
| Basic skills taxonomies: | Classification systems which identify a hierarchy of reading, mathematics, writing, listening, and speaking skills stated in performance terms. |
| Job-related basic skill tasks: | Reading, mathematics, writing listening, and speaking tasks in conjunction with occupational tasks. |
| Welder (combination): | A worker who welds metal components together to fabricate or repair products, such as machine parts, plant equipment, mobile homes, motors, & generators, according to layouts, blueprints, or work orders, using brazing & a variety of arc and gas welding equipment. |
| Entry-level welder: | A person entering the occupation of welder. |
| Fully-qualified welder: | A person who has been working as a welder for at least six months. |
| Occupation: | The overall category into which particular duties are catagorized. |
| Duty: | A major category of work which consists of related tasks performed by a worker in a given occupation. |
| Task: | A measurable element of work usually performed by a single worker in a short span of time. Tasks are grouped into duty areas. |
| Task list: | A listing of the identified tasks performed by workers in a given occupation. |

| | |
|---|---|
| Competency: | The demonstrated ability to perform specific tasks. |
| Competency based vocational eduction: (performance based) | Instructional programs which derive their content from the tasks performed in each occupation and assess student performance on the basis of pre-set performance standards. |
| Competency-based instruction: | Instruction which places emphasis upon the ability to do, as well as on learning how and why. Student performance and knowledge is individually evaluated against stated criteria, rather than against group norms. |
| Criterion: | Minimum performance standard which must be met in order to master a specific skill. |
| Criterion-referenced: | An evaluation of student performance or knowledge of a task according to the conditions and standards stated in the performance objective. |
| DOT: (Dictionary of Occupational Titles) | A U.S. Department of Labor publication which consists of standardized occupational information concerning job content and definitions of some 20,000 occupations. |
| VPO: (Vocational Preparations and Occupations Handbook) | A National Occupational Information Coordinating Committee publication designed to link U.S. government codes to occupational classification systems. |
| ERIC: (The Educational Resources Information Center) | A national information system supported and operated since 1966 by the National Institute of Education (NIE) to provide ready access to educational literature by and for educational practitioners and scholars. |

## The Problem

Basic skills such as listening, speaking, mathematics, reading and writing are an integral part of occupational duties and tasks. However, the basic skills portion of vocational training in an educational setting is not usually linked specifically to the technical instruction.

Instructors of basic skills in a vocational/technical college often have general or intuitive information concerning the basic skills required on the job, but lack more data-based information which would link basic skills instruction to the technical training. Vocational counselors, curricula developers, and educational administrators also need more specific information if they are to make informed decisions regarding the basic skill requirements of students in vocational training programs.

Few instructional materials have been developed to aid instructors in teaching occupationally specific basic skills. However, recent research has prompted some publishers' awareness of the increased demand for such materials, and they are beginning to respond.

## The Need

The Utah State Department of Employment Security has projected that the number of new jobs in Utah which are related to vocational/technical education will have increased from 421,300 in 1981 to 554,080 in 1986.[1] Vocational institutions must equip students with the skills necessary for success in those jobs.

It is also becoming increasingly apparent that successful job performance demands a level of proficiency in basic academic skills as well as occupational skills. Yet, few attempts have been made to link basic skills instruction to vocational training and encourage instructors to teach basic skills that are criterion-referenced to specific occupations.

---

[1] Utah Job Outlook for Vocational-Technical Occupations Statewide and Planning Districts, 1981 - 1986. (Salt Lake City, Utah: Labor Market Information Services, Utah Department of Employment Security March 1981)

## Objectives

The following objectives have been set forth in an attempt to address this need to link basic skills to occupational tasks and welder training:

Compile a current list of welder duties and tasks.

Determine the relative frequency with which the occupational tasks are done by welders.

Locate and/or develop basic skills taxonomies which are written in performance terms.

Analyze each occupational task to determine the (specific) basic skills required for task performance.

Link the specific basic skills to each occupational task.

Determine the relative importance of each basic skill (reading, mathematics, writing, listening, and speaking) for entry-level welders.

Compile a list of occupationally specific basic skills instructional materials currently available.

## Background

A study published by the National Institute of Vocational Education illustrates the point that there is a need to define occupationally specific basic skill proficiencies. ". . .It would be most useful to know the level of basic skill attainment of students in different vocational programs so that the gap, if any, between proficiency of students who are preparing for particular occupations and the demands placed on workers in those occupations can be identified and closed."[2]

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[2]Corman, Louise, Basic Skills Proficiencies Of Secondary Vocational Education Students. (Washington D.C.: Vocational Education Study Publication No. 4, U.S. Department of Education, November, 1980).

The U.S. Office of Vocational and Adult Education also supports the idea of linking basic skills to vocational education in the following statement published in the 1979 Federal Register: "Basic educational skills are essential to all persons, and vocational education must complement basic skills/remedial programs if persons are to succeed in vocational education programs.[3]

The Dictionary of Occupational Titles (DOT), Fourth Edition, provides ratings which indicate the complexity of "worker functions" in every occupation. These ratings were designed to provide information concerning the skills necessary in working with data (including numbers, words, symbols, and concepts), people and things.[4] This system addresses the need for both academic and occupational skills on the job. However, the aforementioned National Institute of Education study expresses the limitations of the DOT ratings. "These ratings permit only indirect inferences about the level of reading, writing, and arithmetic skills required in jobs."[5]

Another step toward linking academic skills to occupational tasks is the Vocational Preparation and Occupations Handbook (VPO), which was developed in 1979 by the National Occupational Information Coordinating Committee.[6] The primary purpose of the VPO is to integrate various occupational and U.S. government classification systems. However, the focus of the publication is not entry-level and the GED (General Educational Development) classification system it employs uses general terms which are difficult to translate into basic skills instruction.

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[3]Federal Register (June 13, 1970), p. 33961

[4]Dictionary of Occupational Titles. Fourth Edition U.S. Department of Labor, Employment and Training Administration. Superintendent of documents, U.S. Government Printing Office, Washington, D.C., 1979.

[5]Corman, op. cit.

[6]National Occupational Information Coordinating Committee, Vocational Preparations & Occupations, Interim Edition, Volume I, Occupational and Educational Code Crosswalk. (Ventura County Superintendent of Schools Office, 1979.)

Occupational Task Analysis

Occupational task analysis is another response to the need for defining tasks performed by workers and the skills needed on the job. Task analyses are, however, oriented mostly toward occupational tasks, not academic skills required to perform the tasks. In a study funded through the Massachusetts State College, G. Porter Horne notes that, "Most job (task) analyses have not been specifically oriented toward identifying reading, writing, and math skills required for job performance," and, "Business and industry also operate a number of basic skills training programs. However, research on these programs failed to discover any cooperation between task analysts and directors of reading, writing, and/or math programs."[7]

Few occupationally specific basic skills analyses have been attempted, and nationally developed occupational task analyses do not always reflect local training considerations.

## Philosophy

Since the basic academic skills needed to perform occupational tasks are not necessarily the same skills learned in a traditional classroom setting, it is important to determine the specific basic skills which industry requires of entry-level welders. Training can be criterion-referenced to that particular occupation. For instance, a welder may need to refer to an operator's manual before operating a cutting machine. This type of basic reading skill can be taught in conjunction with occupational skills in a vocational training program.

Basic skills which are useful for accomplishing an occupational task might be termed "job-related basic skills." When a welder discusses a work order with his/her supervisor, the conversation consists of a series of job-related listening and speaking skills which are directly linked to the job task. In vocational education, where training is often a "hands on" simulation of the actual work setting, a competency-based approach to basic skills which states those skills in peformance terms is a more relevant one.

This study does not take an approach to basic skills based upon grade level proficiencies or "survival (life) skills"; rather, it takes an occupationally specific approach which is criterion-referenced to the occupation of welder and is competency-based.

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[7]G. Porter Horne, Functional Job Literacy: Implications for Instruction. (Boston, Mass., 1979, Massachusetts State College System).

Teaching basic skills in a vocational context provides students with an opportunity to relate basic academic skills to an occupation for which they have an expressed interest. Because vocational students are motivated to learn the job skills required of the occupation, it is assumed that job-related basic skills can add meaning and purpose to the basic skills portion of students' vocational training programs.

## Methodology

1. ERIC Search

An ERIC (Educational Resources Information Center) search was conducted in the spring of 1981 to find literature describing research on basic skills in relationship to the occupation of welder. Information obtained as a result of this search was analyzed for its relevance to this project. The following descriptors were used in the search which encompassed the years from 1970 to 1981:

- Welders
- Arc welding
- Gas welding
- Job skills
- Employment qualifications
- Entry workers
- Adult basic education
- Vocational education
- Vocational training
- Adult vocational training
- Technical education
- Trade and industrial ed.
- Content area reading
- Functional reading
- Remedial reading
- Literacy
- Functional Literacy
- Blue collar occupation
- Skilled workers
- Skilled occupation
- Basic skills
- Employable skills
- Communication skills
- Remedial mathematics
- Training (occupational)
- Workers
- Curriculum
- Competency-based education
- Task performance
- Job analysis
- Reading skills
- Minimum competencies
- Occupational information
- Industrial training
- Pretechnology programs

Highlights of the ERIC search:

A review of the literature obtained through ERIC revealed some studies pertaining to basic skills and occupational task performance. Those which indicated a correlation between reading, mathematics, writing, listening, and/or speaking skills and occupational tasks were read carefully to determine whether a linkage between precise basic skills and welder tasks had already been developed in other geographic areas.

Some attempts had, in fact, been made to link basic skills to occupational tasks. The following projects were found to be significant:

A rather large research project was developed in Prince Albert, Saskatchewan in 1975. The results, published in the Generic Skills Handbook of Occupational Information, appears to have been the first extensive attempt at linking basic skills to occupational tasks.

The California State Department of Education sponsored a 1977 project, Adult Competency Education (ACE) Kit: Basic Skills in Speaking, Math, and Reading for Employment, which includes research in more than 70 occupations.

The Instructional Materials Laboratory at Ohio State University has developed Task/Activity Analyses for many technical occupations which include some basic skills requirements.

A 1980 project, currently being field-tested in vocational and secondary educational institutions countrywide, was undertaken by the Cornell Institute for Occupational Education. This project is entitled Teaching Basic Skills Through Vocational Education.

While these projects are significant, none identifies the exact basic skills needed to perform occupational tasks in a given occupation.

2. Telephone contacts and form letter

Telephone numbers and addresses of new contacts were compiled from: The ERIC search, program reports located in the Salt Lake Skills Center Curriculum Development office, the reading and mathematics libraries, and professional contacts obtained from other staff members.

A form letter describing the Salt Lake Skills Center project was drafted to solicit any current information of programs being developed to link basic skills to vocational training. (See Appendix A for a copy of this letter. Eighty-one letters were sent and 21 responses were received.

Approximately fifty telephone contacts were made to agencies and institutions such as the United States Office of Education, the National Institute of Vocational Education, colleges, universities, state boards and departments of education, post-secondary technical institutions and community colleges, military branches of the government, and private businesses and industries throughout the United States and Canada.

Research reports, program reports, bibliographies, catalogues, curricula, anecdotal experience, and recommendations were obtained from these contacts. A directory of programs developed and studies conducted nation-wide was compiled as a resource to be used for future reference.

A library consisting of occupationally-oriented basic skills materials was set up in the Salt Lake Skills Center Curricula Development Office.

3. Design of the survey form linking basic skills to occupational tasks (See Appendix B for sample page from the clerk-typist survey)

a. Occupational task list:

An occupational task analysis for an entry-level welder developed by the Curriculum Materials Service Department of Vocational Education, Colorado State University, was used to formulate the initial task list. This list was then given to local experts in the field who made suggestions for additions and/or deletions on the list.

b. The frequency column:

A column to the right of the occupational task column was included in order for the respondents to report the frequency of performance for each occupational task--daily, weekly, less often than weekly, or never. The tasks which the advisory group reported were never performed by welders locally were included in the occupational task list, but noted in the frequency section as rarely or never performed. Additional experts in the field were consulted after the advisory group had met. These experts indicated that some of the occupational tasks were more appropriately higher level welding tasks. Those tasks were also left on the final task list but are mentioned in Section II (Results and Conclusions).

A total of 174 welder tasks were compiled to become the final task list. (See Section III: Welder Occupational Task List).

An average of the frequency responses for each task was computed to indicate the mean frequency of task performance. For most tasks, an average of seven or more responses indicated in the frequency column was used.

c. Equipment, materials, job aids, machinery, and supplies information:

Space was provided at the right of the frequency column for the purpose of soliciting information concerning any items which are used to accomplish an occupational task. This information was thought to be useful to basic skills instructors interested in teaching occupationally specific basic skills through simulations of actual job situations.

d. Basic skills columns:

The final columns on the far right of the survey page were added for the purpose of soliciting information concerning the basic skill or skills tasks which are performed in order to accomplish each occupational task.

e. Final format of the survey:

Completion of the survey included adding boxes for responses and a project logo at the top of the first page.

4. Design of the basic skills taxonomies
(See Appendix C)

In each skill area (reading, writing, mathematics, listening and speaking) research was conducted to find competency-based descriptions of basic skills which were specific enough for the purposes of the study, yet easily interpreted by the respondents. Several references were consulted to develop the reading, writing, and mathematics taxonomies.

Specialists in reading, writing, and mathematics (who also had some knowlege of vocational education) reviewed the taxonomies which had been developed and modifications were made according to their suggestions.

a. Keys for coding basic skills:

Each basic skill taxonomy was given an alphabetical or numerical coding system so that respondents could record the basic skills on the survey more readily.

5. Sources used to collect data

Members of the advisory group were asked to act as respondents to the survey. The group included:

-Welders from small, medium-sized, and large companies of various types

-Supervisors of entry-level welders from small, medium-sized, and large companies of various types

-Welding, reading, and math instructors

6. Gathering data

Permission was obtained from administrative officials of three companies for individual welders or supervisors from each company to attend a half-day meeting at The Salt Lake Skills Center, a Division of Utah Technical College. Welding, reading, and math instructors were also asked to participate in this advisory group meeting. Lunch was provided after the meeting.

When all the participants arrived, an explanation of the project and the rationale for basic skills research in vocational education was given; the potential positive effects on training that this research could provide were discussed.

The participants were divided into three groups. Each group included (1) a line-level welder, (2) a supervisor, and (3) a welding instructor. Basic skills instructors worked with the groups as consultants. Each group focused on one or two of the basic skills taxonomies when determining the basic skills column. One member of each group acted as a scribe to record data exclusive of frequency data.

## Suggested uses for this Study

The information gathered in this study is useful to various individuals concerned with vocational education--counselors, instructors, administrators, and curricula developers.

Counselors can use the information to better determine the basic skill needs of students entering welding training programs, give students specific information concerning both academic and occupational skills necessary for welders or as a guide in sequencing schedules which meet each student's individual basic skill needs as well as his/her occupational skill needs.

Vocational instructors can use the information to determine whether the curricula being used is up-to-date and reflects the current needs of local industry and to communicate with basic skills instructors--in performance terms--concerns about individual students' competencies in the basic skills.

Basic skills instructor can use the information to become familiar with some specific applications of job-related basic skills tasks that are performed by welders to determine which basic skills are the most significant as well as those which are the least significant for welding students, plan curricula which reflects the basic skill needs of each student's training program, and communicate the job-relatedness of basic skills taught in the classroom or shop to students.

Vocational program directors and administrators can use the information to become more aware of the occupationally relevant basic skill needs of welding students and the benefits of a job-related basic skills program. They can also use this manual to identify and communicate to staff members ( instructors, counselors, job placement personnel, etc.) the performance demands of industry.

Curricula developers can use the information to develop curricula which is occupationally relevant and specific and as a guide for locating instructional materials which present information on occupationally specific basic skills.

The following chart outlines sections of the manual which are particularly helpful to counselors, vocational instructors, basic skills instructors, directors/administrators, and curricula developers.

| | |
|---|---|
| COUNSELORS | Section I<br>Section II<br>Section IV |
| VOCATIONAL INSTRUCTORS | Section I<br>Section II<br>Section III<br>Section IV |
| BASIC SKILLS INSTRUCTORS | Section I<br>Section II<br>Section IV |
| DIRECTORS AND ADMINISTRATORS | Section I<br>Section II<br>Section III<br>Section IV |
| CURRICULA DEVELOPERS | Section I<br>Section II<br>Section III<br>Section IV |

# Section II
# Summary of Results and Conclusions

Some individuals for whom this report was printed may wish to review a brief summary of the more detailed data in the individual basic skills sections and in the appendixes. Therefore, a percentage analysis of the total basic skills data is provided in figure W-1 along with a narrative summary of the findings in each of the basic skills areas.

The frequency data associated with occupational tasks concludes this section.

The figure below is an analysis of the various basic skill requirements of a welder by percentages:

BASIC SKILLS REQUIRED BY WELDERS ANALYZED
ACCORDING TO PERCENTAGE AND TYPE OF BASIC SKILL TASK

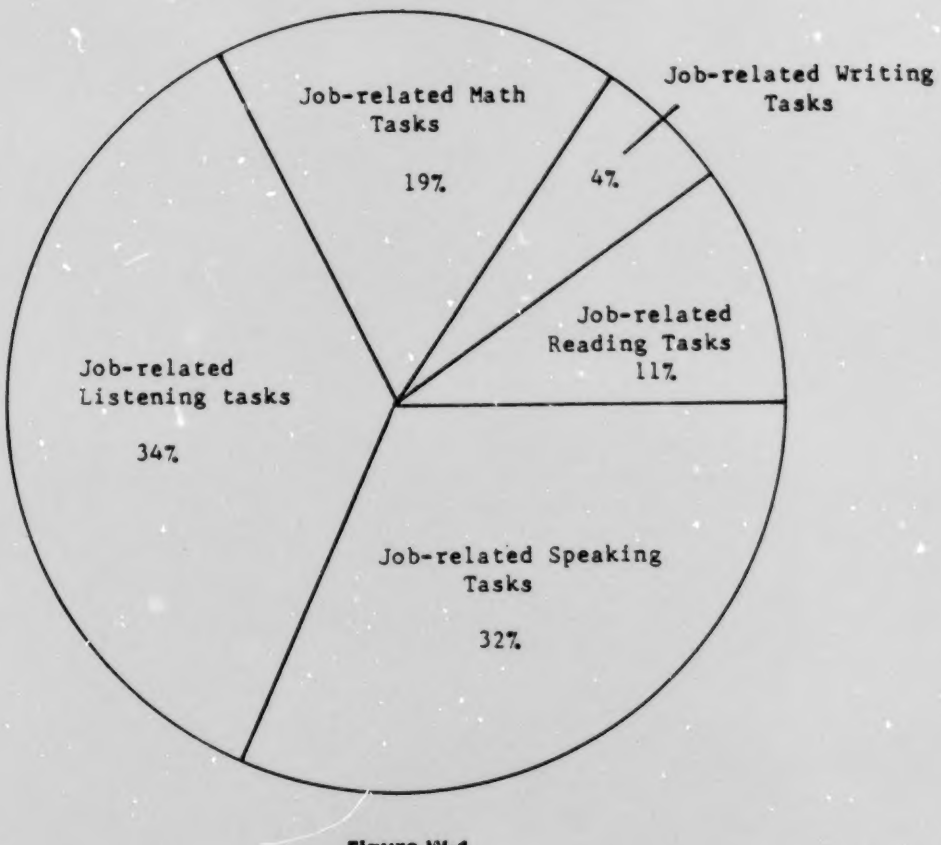


**Figure W-1**

Of the five types of basic skill tasks included in the survey (reading, writing, mathematics, listening and speaking), it was found that listening and speaking tasks were performed more often than the others. Two-thirds (66%) of all the basic skills tasks performed by welders were listening and speaking.

Job-related mathematics tasks accounted for 19% and reading tasks, 11% of all basic skill tasks performed on the job.

Only 4% of all the basic skill tasks performed by welders involved some type of writing.

## Job-Related Reading Tasks

Relative importance of specific reading tasks:

The most important reading tasds in terms of frequency of performance were:

Find facts, figures, specific information
Follow drections or instructions

The least important reading tasks in terms of frequency of performance were:

Interpret writer's intent
Understand concepts
Retain information
Analyze, solve problems
Relate information to another person
Find mistakes or faults
Determine usefulness or importance of information

Duty categories:

The duty categories requiring the greatest number of reading tasks were:

Read drawings
Use shielded metal arc equipment
Identify metals
Perform miscellaneous welding tasks

---

## Job-Related Math Tasks

Relative importance of specific math tasks:

The most important math tasks in terms of frequency of performance were:

Count or put in order numbers
Compute (add, subtract, multiply, divide)
Interpret or construct drawings

The least important math tasks in terms of frequency of performance were:

Change from one system of measure to another
Solve algebra problems
Measure with standard measures (English system)

Job-Related Math Tasks, continued

Duty categories:

The duty categories requiring the greatest number of math tasks were:

Weld metals using oxyacetalene equipment
Use shielded metal arc equipment
Use gas tungsten arc equipment
Use gas metal arc equipment

---

Job-Related Writing Tasks

Relative importance of specific writing tasks:

The most important writing tasks in terms of frequency of performance were:

Form letters of the alphabet
Write or print legibly
Compose phrases

The least important writing tasks in terms of frequency of performance were:

Use correct grammar and diction
Punctuate and capitalize correctly

Duty categories:

The duty categories requiring the greatest number of writing tasks were:

Utilize safety practices and techniques
Weld metals using oxyacetalene equipment
Read drawings

---

Job-Related Listening Tasks

Relative importance of specific listening tasks:

The most important listening tasks in terms of frequency of performance were:

Listen to suggestions, referrals, facts
Listen to instructions and criticism

Job-Related Listening Tasks cont.

The least important listening tasks in terms of frequency of performance were:

Listen to persuasive talks
Listen to factual presentations
Listen to job questions

Duty categories:

The duty categories requiring the greatest number of listening tasks were:

Use shielded metal arc equipment
Weld metals using oxyacetylene equipment
Use gas tungsten arc equipment
Perform miscellaneous welding tasks

---

Job-Related Speaking Tasks

Relative importance of specific speaking tasks:

The most important speaking tasks in terms of frequency of performance were:

Ask job questions
Give suggestions, facts, and criticism

The least important speaking tasks in terms of frequency of performance were:

Give facts in a group
Participate in an interview
Use non-verbal language

Duty categories:

The duty categories requiring the greatest number of speaking tasks were:

Weld metals using oxyacetylene equipment
Use shielded metal arc equipment
Use gas tungsten arc equipment
Use gas metal arc equipment

## A SUMMARY OF THE FREQUENCY DATA ASSOCIATED WITH WELDER TASKS AND DUTIES

Each advisory group member was asked to report the frequency with which an entry-level welder performs each of the 174 occupational tasks. The frequency categories provided in the survey were:

Daily
Weekly
Less often than weekly
Never

Individual responses varied widely. In some cases, they varied from "daily" to "never" when reporting the frequency of performance for a single task. Therefore, an average frequency was computed for each occupational task.

If the average frequency of performance was judged to be either "daily" or "weekly," the task was listed separately. Then a comparison was made between the percentage of tasks within each duty category and those tasks which were separated from the rest. (See figure WF-1.)

According to this small sample of individuals surveyed, the relative importance of tasks in each duty category (in terms of performance frequency) is indicated below:

PERCENTAGES OF TASKS PERFORMED
DAILY OR WEEKLY IN EACH DUTY CATEGORY

| | |
|---|---|
| I. UTILIZE SAFETY PRACTICES & TECHNIQUES | 64% |
| II. READ DRAWINGS | 100% |
| III. PREPARE OXYACETYLENE EQUIPMENT | 100% |
| IV. CUT METALS USING OXYACETYLENE EQUIPMENT | 100% |
| V. WELD METALS USING OXYACETYLENE EQUIPMENT | 44% |
| VI. USE SHIELDED METAL ARC EQUIPMENT | 57% |
| VII. IDENTIFY METALS | 18% |
| VIII. USE GAS METAL ARC EQUIPMENT | 88% |
| IX. USE GAS TUNGSTEN ARC EQUIPMENT | 90% |
| X. USE RESISTANCE WELDING EQUIPMENT | 0% |
| XI. USE CARBON ARC AND AIR CARBON ARC EQUIPMENT | 91% |
| XII. PERFORM MISCELLANEOUS WELDING TASKS | 34% |

**Figure WF-1**

Frequency Data, continued

The advisory group data indicated that the following duty categories included tasks which were performed most often by entry-level welders: Reading drawings; Preparing oxyacetylene equipment, Cutting metals using oxyacetylene equipment, Using carbon arc and air carbon arc equipment, Using gas metal arc equipment, and Using tungsten arc equipment.

One-hundred percent of the tasks in the categories of Reading drawings, Preparing oxyacetylene equipment and Cutting metals using oxyacetylene equipment were performed at least once daily or weekly.

Ninety-one percent of the tasks in the category of Using carbon arc and air carbon arc equipment were performed at least once daily or weekly.

Using gas tungsten arc equipment and Using gas metal arc equipment included 90% and 88% of the tasks (respectively) which were performed daily or weekly.

Sixty-four percent of the tasks in the category of Utilizing safety practices and techniques, 57% of the occupational tasks under the category of Using shielded metal arc equipment, and 54% of the tasks included in the category of performing miscellaneous welding activities were performed daily or weekly.

Forty-four percent of the tasks under Welding metals using oxyacetylene equipment were done daily or weekly.

Identifying metals and Using resistance welding equipment were two duty categories which contained tasks the group reported were done least often or never. Only 18% of the tasks included in the category of Identifying metals were done daily or weekly, and 0% of the tasks in the category of Using resistance welding equipment were performed daily or weekly by entry-level welders.

Tasks performed with the highest frequency

The advisory group reported that the following welder tasks were performed at least once daily:

Exhibit personal safety awareness
Wear devices which provide eye protection
Wear protective clothing
Wear devices which provide ear protection
Clean own work areas
Operate equipment safely (welding, cutting, grinding)
Read welding symbols from prints
Interpret all views (front, top, and end views) on drawings
Read dimensions

Tasks performed with the highest frequency, cont.

Use basic mathematics including fractions
Check welding specifications
Adjust regulators for correct pressures
Adjust flames
Shut off torches and drain systems
Prepare metal surfaces
Utilize proper cutting techniques
Perform cutting operations
Set up alternating current (AC) equipment
Set up direct current (DC) equipment
Select electrodes
Prepare metals for welding
Strike arcs
Clean beads
Recognize metals by appearance
Clean and maintain equipment
Store equipment
Set up equipment
Adjust equipment
Weld metals with filler rods
Check work conditions for safety
Control direction in molten metals arc blow
Strike arcs
Cut metals using air carbon arc equipment
Use single arc equipment
Use hand signals recognized by occupational safety and health administration personnel
Use hand grinders
Maintain hand tools
Control distortion in metals
Clean up own bay area after each operation or daily

Tasks never performed by entry-level welders as reported by group

The advisory group reported that the following tasks were never performed on the job:

Weld metals without filler rods
Weld lap joints on guaged metals in all positions
Weld tubings in all positions
Weld high carbon steels
Preheat and postheat cast steels
Weld cast steels
Preheat and postheat cast irons
Weld cast irons
Preheat and postheat galvanized irons
Weld galvanized irons
Perform multi-pass welds

Tasks never performed by entry-level welders as reported by group

Solder metals (silver solder)
Solder metals (soft solder)
Hard-surface metals
Weld cast aluminums
Weld tubings in all positions (6)
Perform shavings tests
Perform spark tests
Perform hardness tests using files
Perform hardness tests using conventional test equipment
Recognize elasticity of metals from tests
Recognize tensile strength of metals from tests
Specify types of metals
Use resistance welding equipment

## Section III
# Welder Occupational Task List

WELDER OCCUPATIONAL TASK LIST
ACCORDING TO DUTY CATEGORIES

UTILIZE SAFETY PRACTICES & TECHNIQUES

- Exhibit personal safety awareness
- Wear devices which provide eye protection
- Wear protective clothing
- Wear devices which provide ear protection
- Clean own work areas
- Report hazards
- Report accidents immediately
- Take appropriate emergency actions in case of injury
- Apply first aid techniques
- Operate equipment safely (welding, cutting, grinding)
- Attend meetings (safety and procedural)

READ DRAWINGS

- Read welding symbols from prints
- Interpret all views (front, top, end views)
- Read dimensions
- Use templates
- Lay out work
- Use basic mathematics including fractions
- Check welding specifications

PREPARE OXYACETYLENE EQUIPMENT

- Check work conditions for safety
- Set up equipment
- Adjust regulators for correct pressures
- Check for gas leaks
- Adjust flames
- Shut off torches and drain systems
- Clean and store equipment

WELDER OCCUPATIONAL TASK LIST
ACCORDING TO DUTY CATEGORIES, cont.

CUT METALS USING OXYACETYLENE EQUIPMENT

- Check work conditions for safety
- Prepare metal surfaces
- Utilize proper cutting techniques
- Perform cutting operations

USE OXYACETYLENE EQUIPMENT

- Check work conditions for safety
- Prepare metal surfaces
- Prepare joints
- Weld metals without filler rods
- Weld lap joints on guaged metals in all positions-
- Weld butt joints on guaged mitals in all positions
- Weld corner joints on guaged metals in all positions
- Weld edge joints on guaged metals in all positions
- Weld pipes in all positions
- Weld tubings in all positions
- Weld high carbon steels
- Preheat and postheat cast steels
- Weld cast steels
- Preheat and post heat cast irons
- Weld cast irons
- Preheat and post heat galvanized irons
- Weld galvanized iron
- Perform multi-pass welds
- Braze materials
- Solder metals (silver solder)
- Solder metals (soft solder)
- Hard-surface metals
- Heat treat metals
- Form metals
- Bend metals
- Clean and store equipment

WELDER OCCUPATIONAL TASK LIST
ACCORDING TO DUTY CATEGORIES, cont.

USE SHIELDED METAL ARC EQUIPMENT

- Check work conditions for safety
- Set up alternating current (AC) equipment
- Set up direct current (DC) equipment
- Select electrodes
- Prepare metals for welding
- Strike arcs
- Run beads in all positions (4)
- Clean beads
- Weld lap joints in all positions (4)
- Weld corner joints in all positions (4)
- Weld butt joints in all positions (4)
- Weld T-joints in all positions (4)
- Weld edge joints in all positions (4)
- Make plug welds
- Make slot welds
- Cut metals
- Gouge metals
- Weld cast steels
- Weld alloy steels
- Weld tool and die sheets
- Weld stainless steels
- Weld cast irons
- Weld cast aluminums
- Weld pipes in all positions (6)
- Weld tubings in all positions (6)
- Build up shafts
- Hard-surface metals
- Clean and store equipment

IDENTIFY METALS

- Recognize metals by appearance
- Perform magnet tests
- Perform spark tests
- Perform shavings tests
- Perform hardness tests using files
- Perform hardness tests using conventional test equipment
- Recognize ductility of metals from tests
- Recognize elasticity of metals from tests
- Recognize tensile strength of metals from tests
- Recognize non-destructive techniques of testing metals
- Specify types of metals

WELDER OCCUPATIONAL TASK LIST
ACCORDING TO DUTY CATEGORIES, cont.

USE GAS METAL ARC EQUIPMENT

- Check work conditions for safety
- Set up equipment
- Adjust equipment
- Prepare metal surfaces
- Weld lap joints in all positions (4)
- Weld butt joints in all positions (4)
- Weld T-joints in all positions (4)
- Weld corner joints in all positions (4)
- Weld edge joints in all positions (4)
- Hard-surface metals
- Weld aluminums
- Weld low alloy metals
- Weld stainless steels
- Make spot welds (repairs)
- Clean beads
- Clean and maintain equipment
- Store equipment

USE GAS TUNGSTEN ARC EQUIPMENT

- Check work conditions for safety
- Set up equipment
- Adjust equipment
- Prepare metal surfaces
- Run beads in all positions (4)
- Weld metals without filler rods
- Weld corner joints in all positions (4)
- Weld metals with filler rods
- Weld lap joints in all positions (4)
- Weld butt joints in all positions (4)
- Weld edge joints in all positions (4)
- Weld T-joints in all positions (4)
- Weld stainless steels
- Weld aluminums
- Weld alloy metals
- Make spot welds
- Weld ferrous metals
- Weld non-ferrous metals
- Clean and maintain equipment
- Store equipment

WELDER OCCUPATIONAL TASK LIST
ACCORDING TO DUTY CATEGORIES, cont.

USE RESISTANCE WELDING EQUIPMENT

Check work conditions for safety
Set up equipment
Adjust equipment
Prepare matals for welding
Adjust electrode pressures
Make spot welds
Clean and store equipment

USE CARBON ARC AND AIR CARBON-ARC EQUIPMENT

Check work conditions for safety
Set up equipment
Check for correct air pressures
Control direction in molten metals arc blow
Strike arcs
Cut metals using air carbon-arc equipment
Gouge metals using air carbon-arc ecuipment
Use single arc equipment
Use twin-electrode arc torches
Run beads
Clean and store equipment

PERFORM MISCELLANEOUS WELDING ACTIVITIES

Use hand signals recognized by occupational safety and health administration personnel
Use track torches
Use hand grinders
Use pedestal grinders
Use torch pipe bevelers
Use breaks
Use drill presses with clamp stops
Use band saws
Use shears
Use ironworkers
Use cut-off saws
Operate automatic welding equipment
Operate automatic cutting equipment
Maintain hand tools
Control distortion in metals
Clean up own bay area after each operation or daily

WELDER OCCUPATIONAL TASK LIST
ACCORDING TO DUTY CATEGORIES, cont.

PERFORM MISCELLANEOUS WELDING ACTIVITIES, cont.

Keep time records
Keep material usage records
Maintain job resumes
Utilize correct procedures in searching for jobs
Utilize correct procedures in making job applications
Recognize certification and its responsibilities
Recognize various work opportunities such as
apprenticeships

## Section IV
# Basic Skills Tasks Linked to Welder Tasks

# Job-Related Listening and Speaking

## Related Terminology

| | |
|---|---|
| Basic listening and speaking skills: (ocupationally oriented) | Essential listening and speaking skills needed to secure and maintain employment. |
| Listening taxonomy: | Classification system which identifies specific listening skills stated in performance terms. |
| Speaking taxonomy: | Classification system which identifies specific speaking skills stated in performance terms. |
| Job-related listening and speaking tasks: | Listening and speaking tasks performed in conjunction with occupational tasks. |
| Welder (combination): | A worker who welds metal components together to fabricate or repair products, such as machine parts, plant equipment, mobile homes, motors, & generators, according to layouts, blueprints, or work orders, using brazing & a variety of arc and gas welding equipment. |
| Entry-level welder: | A person entering the occupation of welder. |
| Occupation: | The overall category into which particular duties are catagorized. |
| Duty: | A major category of work which consists of related tasks performed by welders. |

| | |
|---|---|
| Task: | A measurable element of work usually performed by a single worker in a short span of time. Tasks are grouped into duty areas. |
| Task list: | A listing of the identified tasks performed by workers in a given occupation. |
| Competency: | The demonstrated ability to perform specific tasks. |

## Job-Related Listening and Speaking

Listening and speaking are a large part of job communications. Management personnel in industry have commented that, "Skill in effective communications is one of the most important abilities we look for in technically-trained employees."[8] Some examples of listening and speaking are: Ordering materials, instructing another employee on the use of a machine, listening to verbal instructions, and discussing a work order.

Job-related listening and speaking skills are used between individuals and among groups. A recent Washington state study, however, concluded that listening and speaking to one person, face-to-face was the most frequent type of communication used on the job.[9]

Non-verbal skills are often used in communicating at work as well. Facial expressions, gestures, and body posture are unspoken messages to others. For example, gesturing to a fellow employee can communicate a message to turn off a machine. Non-verbal messages are given with or without verbal communication. If they are used together with listening and speaking, they affect the message being communicated.

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[8]U.S. Department of Health, Education, and Welfare, Occupational Communications Skills Analysis. Final report. Public Law 90-576, Washington State Commission for Vocational Education, 1976.

[9]Frank H. Wimer, Communications Requirements for Technical Occupations. Developed under contract with Everett H. Barton, Washington State Coordinating Council for Vocational Education, 1970.

Equipment such as telephones, tape recorders, dictaphones, loudspeakers, and welding machines also require skills in listening and/or speaking. Whether communicating one-to-one, in groups, or with the help of sound devices, communication at work often begins with listening comprehension.

Research indicates that there are three main categories of listening comprehension skills:[10]

Listening skills

1. Literal comprehension
   receiving an oral message

2. Interpretive comprehension
   making sense of or decoding the message received

3. Evaluative comprehension
   deciding on a response, if needed

These basic listening skills are often applied on the job in performing occupational tasks. Job-related listening tasks require all three basic listening skills. These listening skills are defined below in a taxonomy which is written in job-oriented, performance terms. Correlated with the taxonomy are the three basic categories of listening comprehension skills.

[10]Training Research and Development Station, Generic Skills Research and Development, Prince Albert, Saskatchewan 1975.

| Job-related listening task[11] | Listening skill |
|---|---|
| Listen to: | |
| Suggestions<br>Referrals<br>Facts<br>Criticism<br>Instructions<br>Other | 1. Literal<br>2. Interpretive<br>3. Evaluative |
| Listen to Job Questions | 1. Literal<br>2. Interpretive |
| Listen to Factual Presentation in a group | 1. Literal<br>2. Interpretive |
| Listen evaluatively to a persuasive talk | 1. Literal<br>2. Interprative<br>3. Evaluative |
| Listen to on-the-job demonstrations | 1. Literal<br>2. Interpretive |

After receiving an oral message and comprehending it, a worker may need to respond to it verbally. This response requires the basic skill of speaking. There are three main categories of speaking skills.

Speaking skills

1. Pronunciation
   articulating particular sounds

2. Grammar
   combining word forms (morphology) or combining words into phrases or sentences (syntax) according to prescribed rules

3. Diction
   choosing appropriate words and expressions (both general and technical) according to their actual meanings (denotation) as well as their implied meanings (connotation)

[11]Frank H. Wimer, Communications Requirements for Technical Occupations. Developed under contract with Everett H. Barton, Washington State Coordinating Council for Vocational Education, 1970.

These basic speaking skills are defined in terms of a taxonomy which is also written in job-related, performance terms. The three basic speaking skills are again correlated with the speaking tasks.

| Job-related speaking task[18] | Speaking skill |
|---|---|
| Give: | |
| Suggestions<br>Referrals<br>Facts<br>Criticism<br>Instructions<br>Other | 1. Pronunciation<br>2. Grammar<br>3. Diction |
| Ask job questions | (same as above) |
| Give facts in a group discussion | (same as above) |
| Participate in an interview | (same as above) |
| Give an on the job demonstration | (same as above) |
| Persuade:<br>One person<br>A group of people | (same as above) |
| Use non-verbal language | (same as above) |

## DISCUSSION OF THE DATA

Of the 174 occupational tasks listed in the welder survey, preliminay results indicated that 86% of those tasks required some type of listening, and 82% required some type of speaking. The figures on the following pages present percentage breakdowns of the data involving listening and speaking in relation to the job-related taxonomies and the categories of welder duties.

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[12]Frank H. Wimer, op. cit.

WELDER LISTENING TASKS
ANALYZED ACCORDING TO PERCENTAGES OF EACH TYPE OF LISTENING REQUIRED

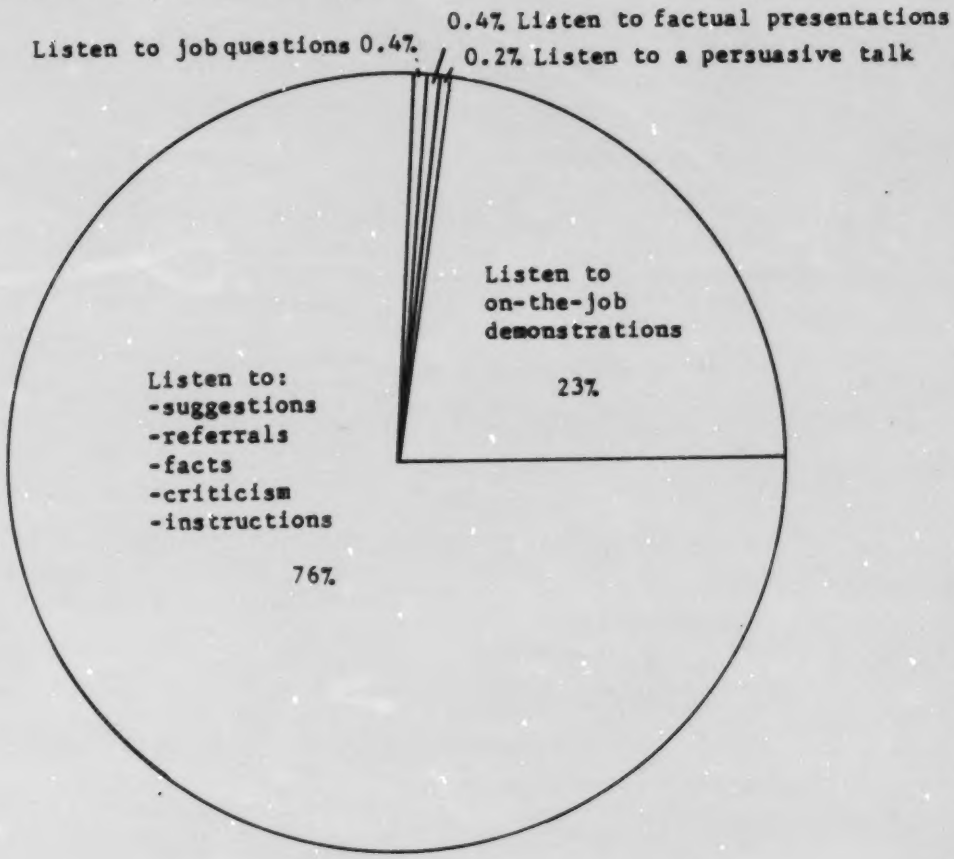



Figure WL-1

The respondents indicated that over three-fourths (76%) of all listening required of welders was listening to: suggestions, referrals, facts criticism, or instructions. Almost one-fourth (23%) was listening to on-the-job demonstrations. Rarely was a welder required to listen to factual presentations (0.4%), job questions (0.4%) or persuasive talk (0.2%).

WELDER LISTENING TASKS
ANALYZED ACCORDING TO DUTY CATEGORY*

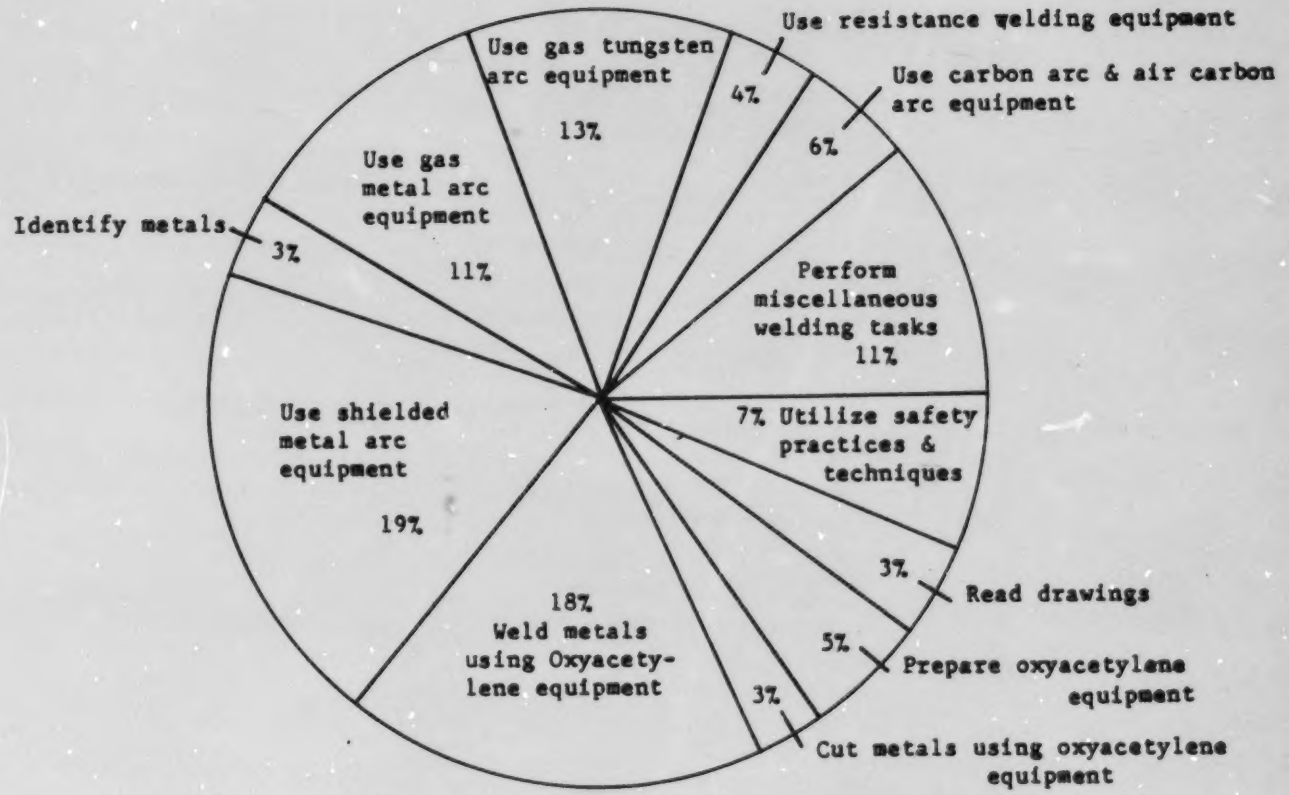



**Figure WL-2**

Respondents indicated that tasks associated with Using shielded metal arc equipment, oxyacetylene equipment, and gas tungsten equipment were linked to half of all job-related listening required of welders (19%, 18%, and 13% respectively).

Using gas metal arc equipment and Performing miscellaneous welding activities, such as operating grinding and cutting machines, each involved 11% of all job-related listening tasks performed by welders.

Listening was required least to perform the following: Utilize safety practices and techniques (7%); Prepare oxyacetylene equipment (5%); Use resistence welding equipment (4%); Read drawings (3%); and Cut metals using oxyacetylene equipment (3%).

*Percentages were rounded off.

WELDER SPEAKING TASKS ANALYZED
ACCORDING TO PERCENTAGES OF EACH TYPE OF SPEAKING REQUIRED

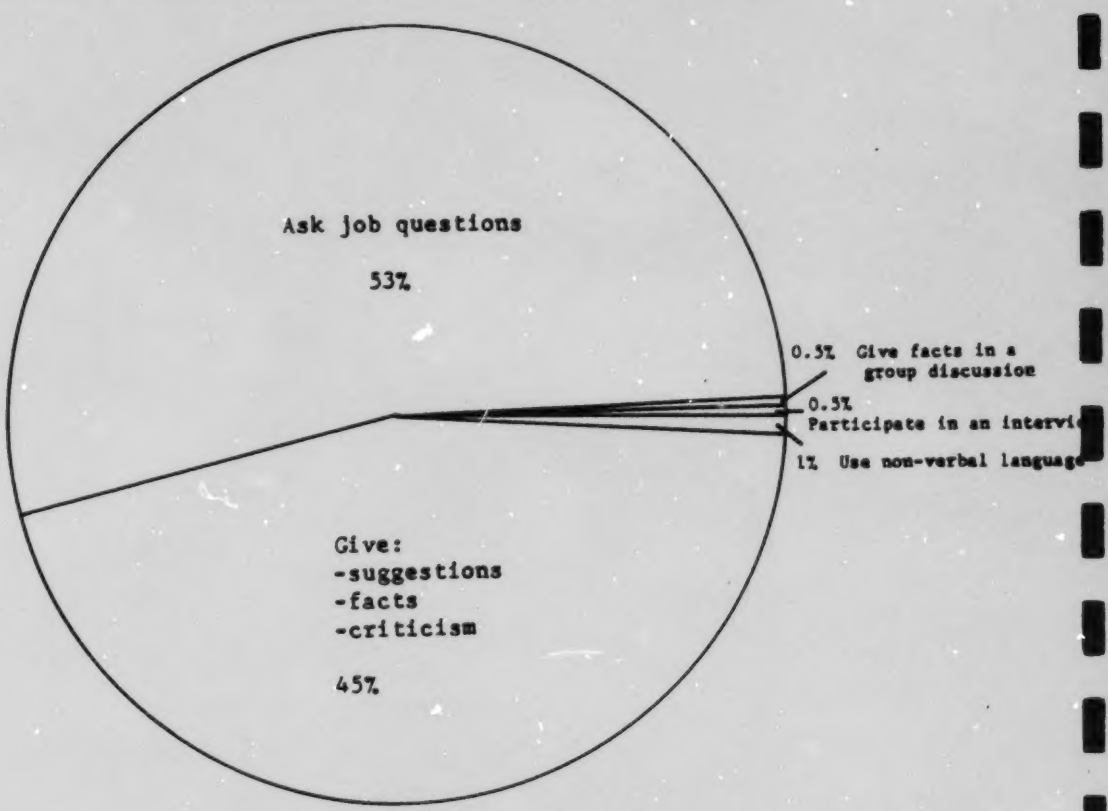



**Figure WS-1**

According to the respondents, over half (53%) of the speaking tasks required of welders consisted of asking job questions and almost half (45%) consisted of giving suggestions, facts, or criticism. Non-verbal language accounted for only 1% of the communication performed by welders; giving facts in a group and participating in an interview comprised 1% (0.5% each) of the speaking tasks performed by welders on the job.

WELDER SPEAKING
ANALYZED ACCORDING TO DUTY CATEGORY*

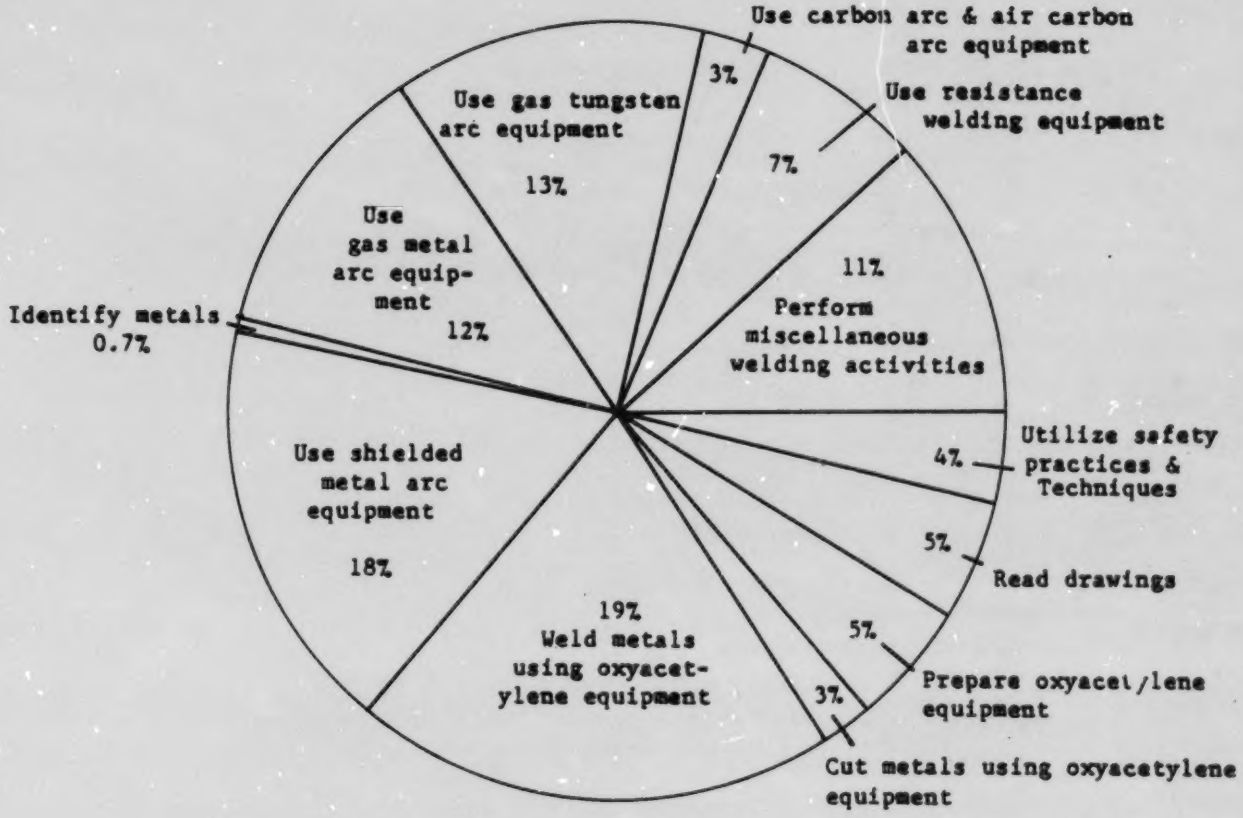



**Figure WS-2**

Job-related speaking tasks performed by welders correlated closely to the job-related listening tasks. Respondents indicated that tasks associated with using oxyacetylene equipment, shielded arc metal equipment, and gas tungsten equipment were linked to a total of half of all job-related speaking required by welders (19%, 18%, and 13% respectively).

Using gas metal arc equipment and performing miscellaneous welding activities (such as operating grinding and cutting machines) involved 12% and 11% respectively, of all job-related speaking tasks performed by welders.

Speaking was required least in the performance of tasks in the following duty areas: Use carbon arc and air carbon arc equipment (7%); Identify metals (7%); Read drawings (5%); Prepare oxyacetylene equipment (5%); Utilize safety practices and techniques (4%); Cut metals using oxyacetylene equipment (3%); and Use resistence welding equipment(3%).

*Percentages were rounded off.

WELDER TASKS
LINKED TO SPECIFIC APPLICATIONS
OF JOB-RELATED LISTENING AND SPEAKING

In order to illustrate how listening and speaking are applied on the job, the following chart gives some examples of job-related listening and speaking performed by welders in each duty category.

| EXAMPLES OF SPECIFIC APPLICATIONS OF JOB-RELATED LISTENING |
|---|
| Follow oral instructions<br>Interpret standard procedures given orally<br>Follow oral specifications<br>Follow various industry procedures given orally<br>Interpret verbal messages<br>Listen for distinctive sounds of the welding process |

| EXAMPLES OF SPECIFIC APPLICATIONS OF JOB-RELATED SPEAKING |
|---|
| Make oral requests for materials<br>Discuss work with quality control person (instructor) according to company policy<br>Appraise work verbally and thoroughly<br>Use proper job terminology<br>Seek information (When in doubt, ask for more information.)<br>Report accidents |

A Practical Program of Listening Training Media Systems, 1982.

Body Language
Multi Media Productions, Social Studies School Service
Two color filmstrips which teach the relationship of body language to verbal communication.

Career Communications Series, Mariestelle M. Brown
Bobbs-Merrill, 1976.
Fifty-three individual programmed learning units which cover reading, writing, and speaking plainly in a career-related manner.

Communicating at Work, Williams and Eggland
South-Western, 1977.
Six chapters dealing with communication with employer, customer, fellow employees, & review.

Communicating at Work, Williams and Eggland
South-Western, 1980.
Deals with communicating more effectively at work and at home through exercises and activities.

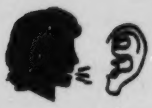
DC Hints for Understanding Your Phone,
The BOE Instructional Mateials Lab, 1979-80.
Bulletin board which illustrates eight difficulties people have in communicating with employers, friends, teachers.

Interpersonal Life Skills Workbook
Singer, 1979.
Cassette tapes teaching active listening, and processing information for success on the job, life skills, etc.

Interpersonal Life Skills Workbook
Singer, 1979.
Student workbook teaches self-appraisal, message sending, listening, perceiving, synchronizing, and relationship building skills.

Listening on the Job
McKnight
Set includes titles such as: "Learning to Listen", "Listening to Learn", "Getting the Message", "Listening With an Open Mind", and "Improving Your Listening Habits".

Listening and Visual Skills IV Teacher Super DuplicatorMaster Book
Visual Materials, Inc., 1980.
How to listen to instructions and follow directions.



## OCCUPATIONALLY SPECIFIC AND GENERAL INSTRUCTIONAL MATERIALS FOR TEACHING JOB-RELATED LISTENING AND SPEAKING, Cont.

Oral Communication
Career
Emphasizes listening and talking skills in job advancement.

Person to Person, an Introduction to Speech Communication, Calvin and Brook
National Textbook Company, 1977.
Text which teaches one-to-one interpersonal communication, group communication, and one-to-group communication.

Snap, Crackle, and Write, Shrank
National Textbook Company, 1979.
Non-verbal communication, listening & interpersonal communication.

Speaking on the Job
McKnight
Casettes include such job-related areas as using the telephone, speaking, and job skills.

The Language of Work, Caleb Crowell
Educational Design, Inc., 1979.
Taped lessons requiring written responses, role playing, overhead projection, and group discussion to teach job-related work skills.

The Language of Work
Career, 1979-80.

Working with Words (Revised), Mildred Putnam
Steck
Speaking and reading skills are taught together with practice in forming words and sentences.

# Job-Related Mathematics

## Related Terminology

| | |
|---|---|
| Basic mathematics skills: (occupationally oriented) | Essential math skills needed to secure and maintain employment. |
| Math taxonomy: | Classification system which identifies a hierarchy of math skills stated in performance terms. |
| Job-related math tasks: | Math tasks performed in conjunction with occupational tasks. |
| Welder (combination): | A worker who welds metal components together to fabricate or repair products, such as machine parts, plant equipment, mobile homes, motors, & generators, according to layouts, blueprints, or work orders, using brazing & a variety of arc and gas welding equipment. |
| Entry-level welder: | A person entering the occupation of welder. |
| Occupation: | The overall category into which particular duties are categorized. |
| Duty: | A major category of work which consists of related tasks performed by clerk-typists |
| Task: | A measurable element of work usually peformed by a single worker in a short span of time. Tasks are grouped into duty areas. |
| Welder task list: | A listing of the identified tasks performed by entry-level welders: |
| Competency: | The demonstrated ability to perform specific tasks. |

## Job-Related Mathematics

Many occupations require the application of basic mathematics skills for success on the job. The ability to apply basic math skills in work settings can be extremely important. In some instances, errors in simple skills such as adding and subtracting may even result in the loss of a job. A welder may be required to measure material to be welded accurately; a salesperson may need to conduct inventories; a carpenter measures distance and temperature in order to build a house.

Thomas Long, in a review of vocational education literature, states that, "There is a paucity of rigorously defined data which document the critical relationships between specific mathematics skills and specific occupations."[13] Another study, by Long and Herr (1973), suggests that while mathematics teachers seem to know the levels of mathematics required of mathematically-oriented professionals, the math requirements for the crafts and skilled trades have been much more difficult to ascertain.[14]

The seven categories of basic mathematics skills that are taught in most fundamental mathematics classes are listed below:

Mathematics skills

1. Quantification (counting and sequencing numbers)
2. Computation (adding, subtracting, multiplying, dividing)
3. Measurement (including estimating and converting)
4. Interpretation and Construction of Drawings and Visual Presentations of Numbers (graphs, tables, schematic drawings, etc.)
5. Ability to Comprehend and Solve Word Problems
6. Ability to Comprehend and Solve Algebra Problems
7. Ability to Comprehend and Solve Geometry Problems

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[13] Long, Thomas E., Basic Mathematics Skills and Vocational Education.

[14] Long, T.E., & E.L. Herr, "Teacher Perceptions of Basic Mathematics Skill Needs in Secondary Vocational Education." The Mathematics Teacher, 1973

The following job-related math tasks are derived from the seven basic mathematics skills and converted into a taxonomy which uses a job-related approach:

| Job-related Math Task | Math Skill |
|---|---|
| COUNT OR PUT IN ORDER:<br>(Verbally or in writing)<br>a. whole numbers<br>b. fractions<br>c. mixed numbers<br>d. decimals (other than money)<br>e. money<br>f. percents<br>g. dates<br>h. time | 1. Quantification |
| COMPUTE:<br>(add, subtract, multiply, divide)<br>a. whole numbers<br>b. fractions<br>c. mixed numbers<br>d. decimals (other than money)<br>e. money<br>f. percents<br>g. distance of lines<br>h. area<br>i. volume<br>j. weight<br>k. force<br>l. time<br>m. rate (speed)<br>n. temperature<br>o. cost<br>p. ratio<br>q. proportion | 2. Computation |
| MEASURE WITH STANDARD MEASURES:<br>(English system)<br>a. distance<br>b. weight (ounces, lbs, etc.)<br>c. temperature (farenheit)<br>d. capacity (pints, quarts, etc.) | 3. Measurement |
| ESTIMATE WITH STANDARD MEASURES:<br>a. distance<br>b. weight<br>c. temperature<br>d. capacity | 3. Measurement |
| CHANGE FROM ONE SYSTEM OF MEASUREMENT TO ANOTHER:<br>a. percents to fractions<br>b. fractions to decimals<br>c. decimals to percents<br>d. English to metric (distance, weight, capacity)<br>e. temperature (farenheit to celcius | 3. Measurement |
| UNDERSTAND AND CONSTRUCT VISUAL PRESENTATIONS OF NUMBERS:<br>a. graphs<br>b. schedules<br>c. tables<br>d. scales<br>e. charts | 4. Interpretation and Construction of Drawings and Visual Presentations of Numbers |
| WORD PROBLEMS:<br>a. solve word problems<br>b. construct word problems | 5. Ability to Comprehend and Solve Word Problems |
| SOLVE ALGEBRA PROBLEMS:<br>a. use letters as symbols<br>b. use specific formulas | 6. Ability to Comprehend and Solve Algebra Problems |
| USE FORMULAS TO EXAMINE GEOMETRIC FORMS AND SHAPES:<br>a. flat shapes<br>b. three-dimensional forms | 7. Ability to Comprehend and Solve Geometry Problems |
| INTERPRET, CONSTRUCT DRAWINGS:<br>a. scale drawings<br>b. assembly drawings<br>c. schematic drawings<br>d. shop drawings | 4. Interpretation and Construction of Drawings and Visual Presentations of Numbers |

## DISCUSSION OF THE DATA

Of the 174 occupational tasks listed in the welder survey, preliminary results indicated that almost half (47%) of those tasks required some type of math task. The following figures present data indicating percentage breakdowns of the math required of welders in relation to the job-related math taxonomy, math concepts, and duty categories of occupational tasks.

WELDER MATH ANALYZED
ACCORDING TO CATEGORIES OF MATH TASKS*

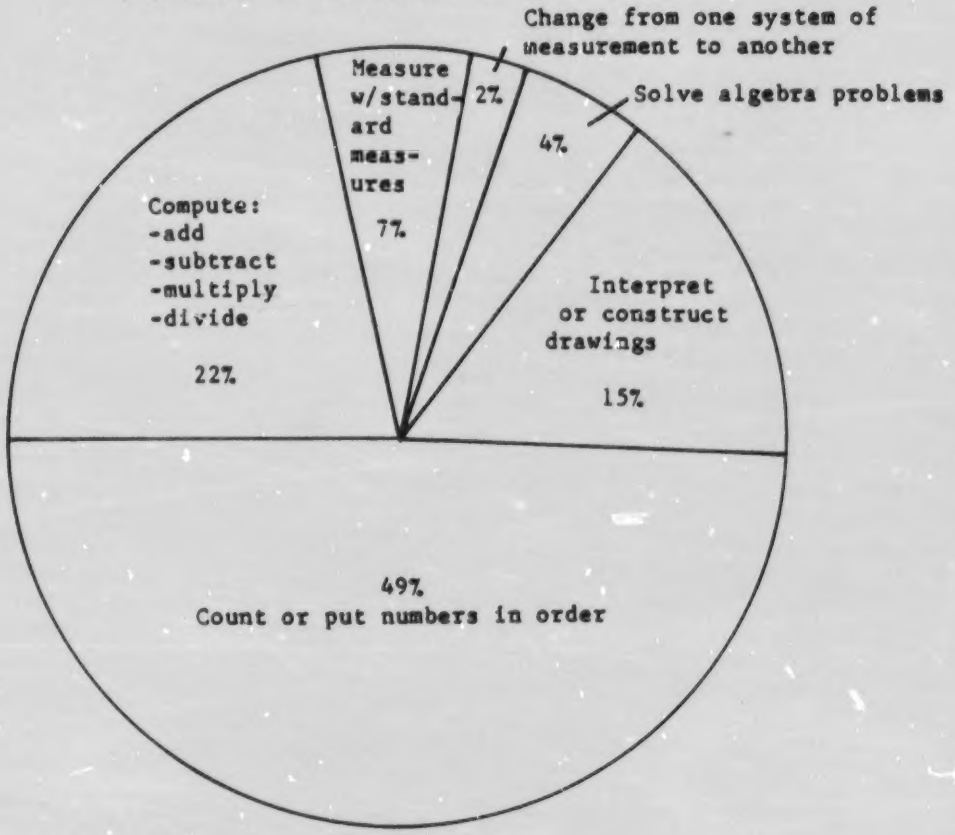


**Figure WM-1**

The tentative data indicated that nearly half of the mathematics required to perform welder tasks were very basic. Counting or ordering comprised 49% of all the job-related math tasks performed by a welder.

Computing (addition, subtraction, multiplication, and division) made up 22% of all the job-related math requirements, and Interpreting or constructing drawings comprised 15% of the mathematics tasks performed by welders.

The remaining 13% of the math tasks required of welders on the job were: Measuring with standard measures (7%); Solving algebra problems (4%); and Changing from one system of measurement to another (2%).

*Percentages were rounded off

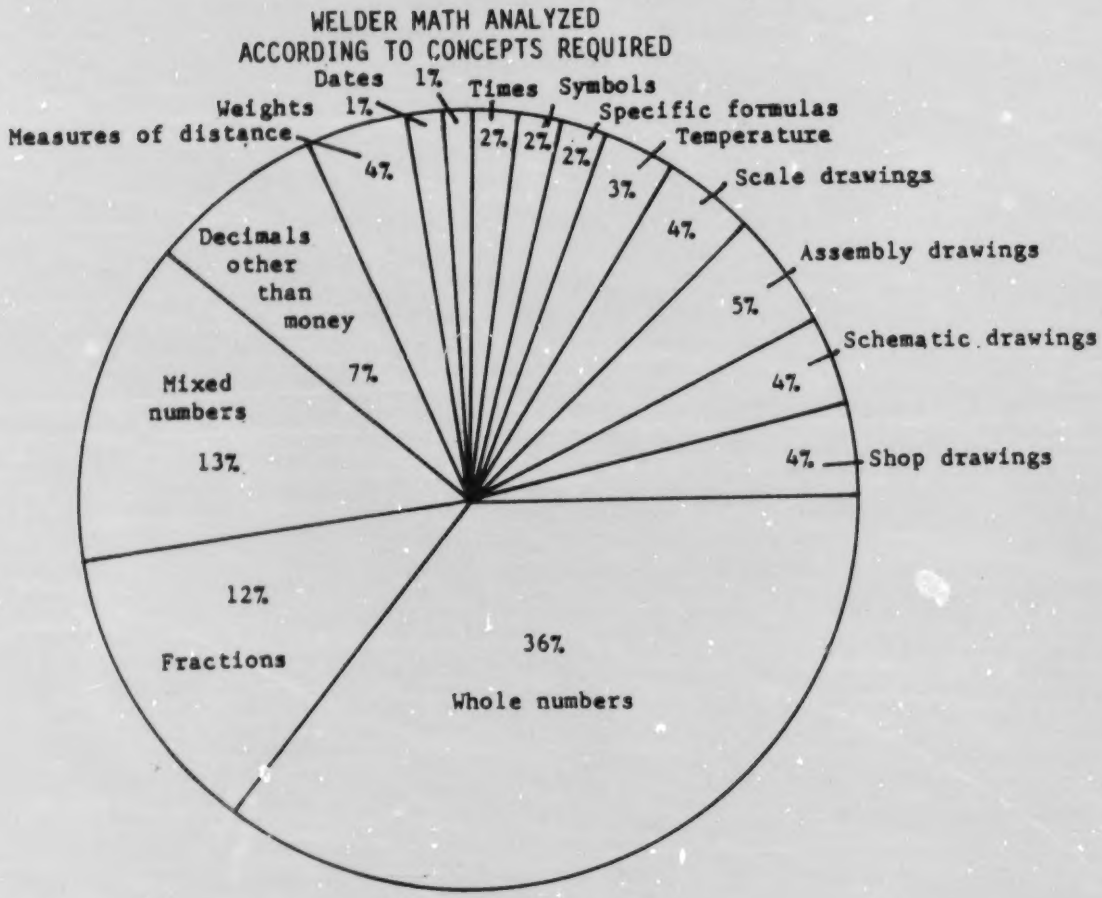


**Figure WM-2**

Over one-third (36%) of the math associated with welder tasks involved the concepts of whole numbers, money, and cost. One-fourth of the math required of welders involved understanding the concepts of fractions (12%) and mixed numbers (13%). Tasks dealing with decimals other than money comprised 7% of the math tasks.

The next most frequently used concept appeared to be those dealing with interpreting drawings and measuring distance. Together, these concepts made up 21% of the math concepts used to perform welder tasks: Assembly drawings (5%); Scale drawings (4%); Schematic drawings (4%); Shop drawings (4%); and Measures of distance (4%).

The remaining welder math tasks involved six additional concepts, each of which represented less than 4% of the total math tasks: Temperature (3%); Specific formulas (2%); Symbols (2%); Time (2%); Dates (1%); and Weight (1%).

WELDER MATH TASKS
ANALYZED ACCORDING TO DUTY CATEGORY

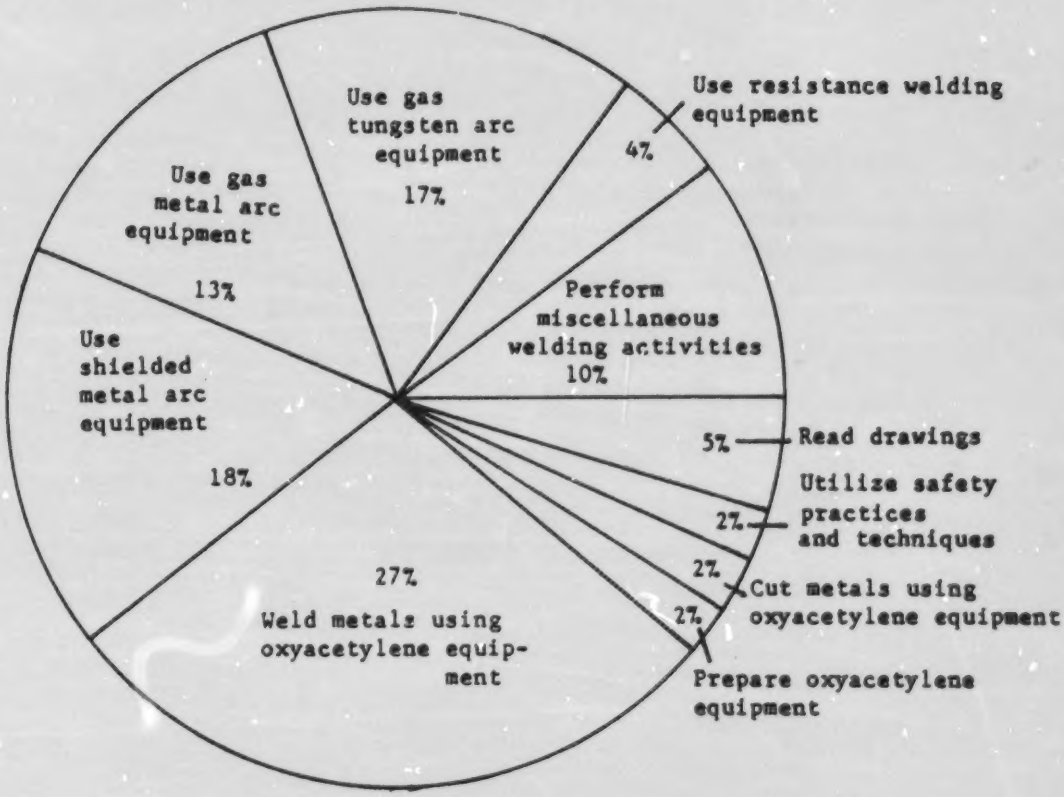


**Figure WM-3**

Just over one-fourth (27%) of the tasks requiring math fell into the duty category of Welding metals using oxyacetylene equipment.

Using shielded metal arc equipment and gas tungsten arc equipment were indicated as duty areas which included a total of 35% of the welder tasks which required job-related math. The percentage breakdown in these areas was 18% and 17%, respectively. Thirteen percent of the math required of welders fell into the category of Using gas metal arc equipment, and 10% into the duty category of Performing miscellaneous welding activities.

Less that 10% of the math necessary for welders fell into the categories of Reading drawings (5%) and Using resistance welding equipment (4%).

The remaining 6% of the math required of welders was evenly divided among the following three duty categories: Utilize safety practices and techniques, Prepare oxyacetylene equipment, and Cut metals using oxyacetylene equipment. Each required 2% of the math necessary for entry-level welders.

The following is a more detailed breakdown of math tasks the advisory group indicated were linked to welder tasks.

PERCENTAGES OF WELDER TASKS
LINKED TO MATH TASKS*

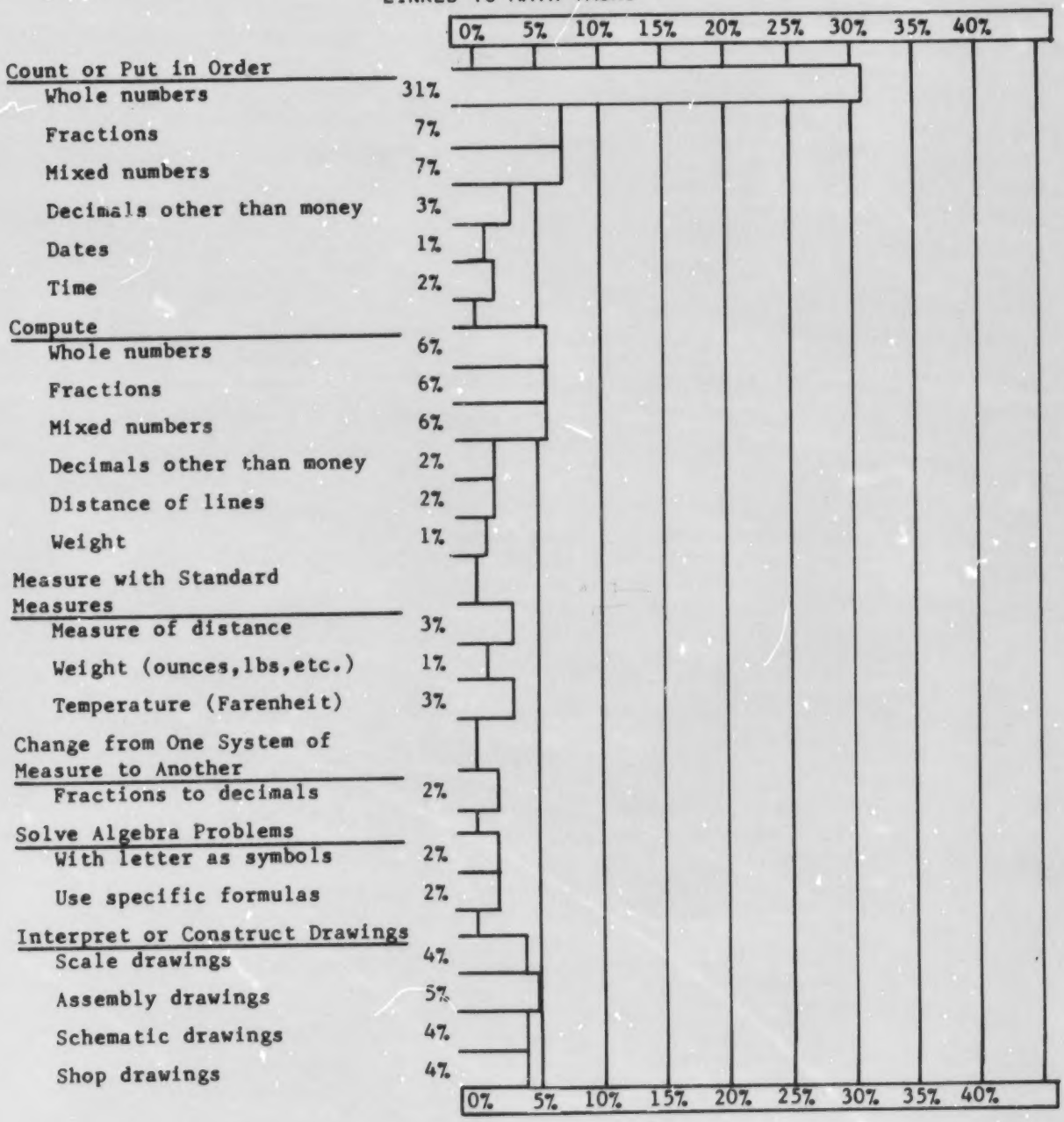


**Figure WM-4**

*Percentages were rounded off.

WELDER TASKS
LINKED TO SPECIFIC APPLICATIONS
OF JOB-RELATED MATH

In order to illustrate how math is applied on the job, the following chart gives some examples of job-related math performed by welders.

| EXAMPLES OF SPECIFIC APPLICATIONS OF JOB-RELATED [illegible] |
|---|
| Determine the amount of weld needed for the job |
| Determine the amount of time needed to perform a welding task |
| Interpret scale drawings blueprints |
| Determine area and circumference of material |
| Determine area and perimeter of material |
| Determine the amount of material needed for the job from drawings |
| Compare the cost of hardfacing to the cost of a new part |
| Use a thermal couple |
| Determine the weight of the material to be used |
| Measure material thickness with vernier (measuring tool) |
| Measure for spacing of holes |
| Check the accuracy of punch marks on the chalk line for correct tolerance |
| Align each part according to job requirements |
| Measure and layout material according to blueprint, sketch, or oral instructions |

Applied Math Problems in Welding, Swearingen
Oregon Vo-Tech Mathematics Problems Sets, 1976.
Individualized learning system which deals with problems with whole numbers, fractions, decimals, measurement, simple equations, and graphs.

Arithmetic for Careers, Brown
Delmar Publishers, 1980.
This text combines arithmetic concepts which provide the student with an ability to apply those concepts to vocational fields and everyday life.

Arithmetic Computation
Adult Education Basic Skills Task Force, Utah State Office of Education, 1982.
Includes: whole numbers, fractions, decimals, converting from one form to another, percent, measurement, identifying geometric figures, computing perimeters and areas, reading and interpreting graphs, etc., in a general context.

Basic Arithmetic Skills and Practical Applications (booklets)
EDL/McGraw-Hill
Whole numbers, Fractions, Decimals & Percents

Blueprint Reading for Welders & Fitters
Hobart School of Welding Technology, 1978.
Programed instruction includes : Measurment, Math concepts as applied to welding

Coordinated Vocational Education and Training, Math (Revised), Spann
State Department of Vocational and Technical Education, Stillwater, Oklahoma.
A text which covers measurement, whole numbers, fractions, decimals, percent, consumer education, and geometry.

Introduction to Metrics, Edgecomb & Shapiro
Vocational Technical Curriculum Lab., Rutgers State Manual.
A manual for technical students which teaches them to "think metric" in relationship to distances, volumes, and weights, etc.

Math Applied to Career Highlights, (MATCH)
Learning Achievement Corp., Gregg Division/McGraw-Hill Book Co., 1981.

Mathematics Skill Book 5500, 6600, 7700, Shea
Steck-Vaughn Company, 1978.
No description available.

Mathematics for Technical and Vocational Students (Seventh Edition), Boyce, Margolis, and Slade
John Wiley and Sons, 1982.
Deals with the metric system, common fractions, decimal, fractions, percentage, ratio, and proportion, and practical algebra, geometry, graphs, logarithms, essentials of trig.

Mathematics for the Trades, Carman and Saunders
John Wiley & Sons, Inc., 1981.
Provides practical mathematics skills needed in a variety of trade and technical areas including welding.

Practical Problems in Mathematics for Welders, Schell and Matlock
Delmar, 1975.
Whole numbers, Fractions, Measurement, including blueprint reading

Reaching Math Competence, Chant, Montalto, & Eufinger
Globe Book Company, Inc., 1981.
Provides skill checks and reviews for students.

Shop Math For The Metal Trades, Newton
Weber State College Skills Center, 1981.
Identifies basic and functional math skills, provides pre-tests, and student learning projects.

Vocational Math Series, David Wiltsie
Mathematical Development, Inc. 1982.
Books 1-9 Include: Fractions, Decimals & Percent (a review); Metric and U.S. systems of measurement; Solving word problems; Practical uses for formulas & equations; Math of geometric shapes and objects; Machine mathematics (gears, pulleys & levers).

Working With Math (and Student Job Sheets), Sushok & Shapiro
State of New Jersey Department of Education, 1976.
A laboratory approach to teaching arithmetic to students in vocational programs who are non-readers.

Working With Numbers (Revised), Shea
Steck-Vaughn Company,1980.
Workbook which deals with whole numbers, fractions, decimals, percent, problems with formulas, ratio, and proportion and simple equations.

# Job-Related Reading

## Related Terminology

| | |
|---|---|
| Basic reading skills: (occupationally oriented) | Essential reading skills needed to secure and maintain employment. |
| Reading taxonomy: | Classification system which identifies a heirarchy of reading skills stated in performance terms. |
| Job-related reading tasks: | Reading tasks performed in conjunction with occupational tasks. |
| Welder (combination): | A worker who welds metal components together to fabricate or repair products, such as machine parts, plant equipment, mobile homes, motors, & generators. |
| Entry-level welder: | A person entering the occupation of welder. |
| Occupation: | The overall category into which particular duties are catagorized. |
| Duty: | A major category of work which consists of related tasks. |
| Task: | A measurable element of work usually performed by a single worker in a short span of time. Tasks are grouped into duty areas. |
| Welder task list: | A listing of the identified tasks performed by welders. |
| Competency: | The demonstrated ability to perform specific tasks. |

## Job-Related Reading

Reading involves developing some fundamental skills and applying them as needed; therefore, reading which is done in order to perform an occupational task requires mastering some basic reading skills and using them on the job. Recognition of both common and technical words and an understanding of their meanings is essential for various job tasks, from referring to a materials list to interpreting job specifications.

A 1980 report published by the Reading Research Center in Bloomington, Indiana, notes that most job-related reading requires reading to perform a specific job task, and that the task itself often provides "context clues" which help workers learn the information quickly, with a minimum of attention. The work setting may actually enable workers to read material they may not be able to read in another setting.[15]

Reading specialists catagorize reading skills into three major areas: Perceptual, decoding, and comprehension skills. Each category is listed below:

Reading skills

1. Perceptual
   a. auditory
   b. visual
   c. motor
2. Decoding
   a. sight vocabulary
   b. structural analysis
   c. syllabication
3. Comprehension
   a. rate
   b. literal
   c. intrepretive
   d. critical

Reading words, symbols, graphs, charts, drawings, etc. in order to do something involves the application of these three basic reading skills as "reading tasks." Job-related reading is often referred to in performance terms. In 1978, Thomas G. Sticht defined job-related reading as. . . "reading to: (1) get a job, (2) learn a job, or (3) do a job. . ." The third category, "reading to do a job," is typically used by workers in occupational areas such as clerical, welding, electronic technology, carpentry, etc. These workers generally read job-related materials in order to find specific information that will help them accomplish a task at hand.[16]

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[15]Mikulecky, L. and Diehl, W. Job Literacy: A Study of Literacy Demands, Attitudes, and Strategies in a Cross-Section of Occupations. Bloomington, Indiana: The Reading Research Center, 1980.

[16]Sticht, T.G. (ed.) Job-Related Reading Tasks: Teaching Marginally Literate Adults to Read, 1978.

A taxonomy which takes a job-related approach to basic reading skills by presenting them in performance terms is listed below. Correlated with the taxonomy are the three main categories of reading skills. Sub-categories are noted where the skills are not all inclusive.

| Job-related reading task [17] | Reading skill [18] |
|---|---|
| Read to: follow directions/instructions | 1. perceptual<br>2. decoding<br>3. comprehension<br>a. rate<br>b. literal |
| find facts, figures, or specific information | (same as above) |
| understand the meaning of facts | (same as above) |
| determine the usefulness/ importance of information | 1. perceptual<br>2. decoding<br>3. comprehension<br>a. rate<br>b. literal<br>c. interpretive |
| relate information to another person | (same as above) |
| find mistakes/faults | (same as above) |
| retain information | 1. perceptual<br>2. decoding<br>3. comprehension<br>a. rate<br>b. literal<br>c. interpretive<br>d. critical |
| analyze/solve problems | (same as above) |
| understand concepts (concrete/abstract) | (same as above) |
| interpret writer's intent | (same as above) |

---

[17] Mikulecky, L. and Diehl, W., op. cit.

[18] Hammill, D. and McNutt, G., Correlates of Reading: The Consensus of Thirty Years of Correctional Research, PRO-ED #1, Austin, Texas, 1981.

## DISCUSSION OF THE DATA

Of the 174 welder tasks surveyed, preliminary results indicated that only 29% of the tasks performed by welders required some type of reading. Figure WR-1 presents a percentage of breakdown of each type of reading invclved in the performance of welder tasks.

Figure WR-2 presents a percentage breakdown of reading involved in each of the duty categories for the occupation of welder.

WELDER TASKS ANALYZED ACCORDING
TO PERCENTAGES OF EACH TYPE OF READING REQUIRED*

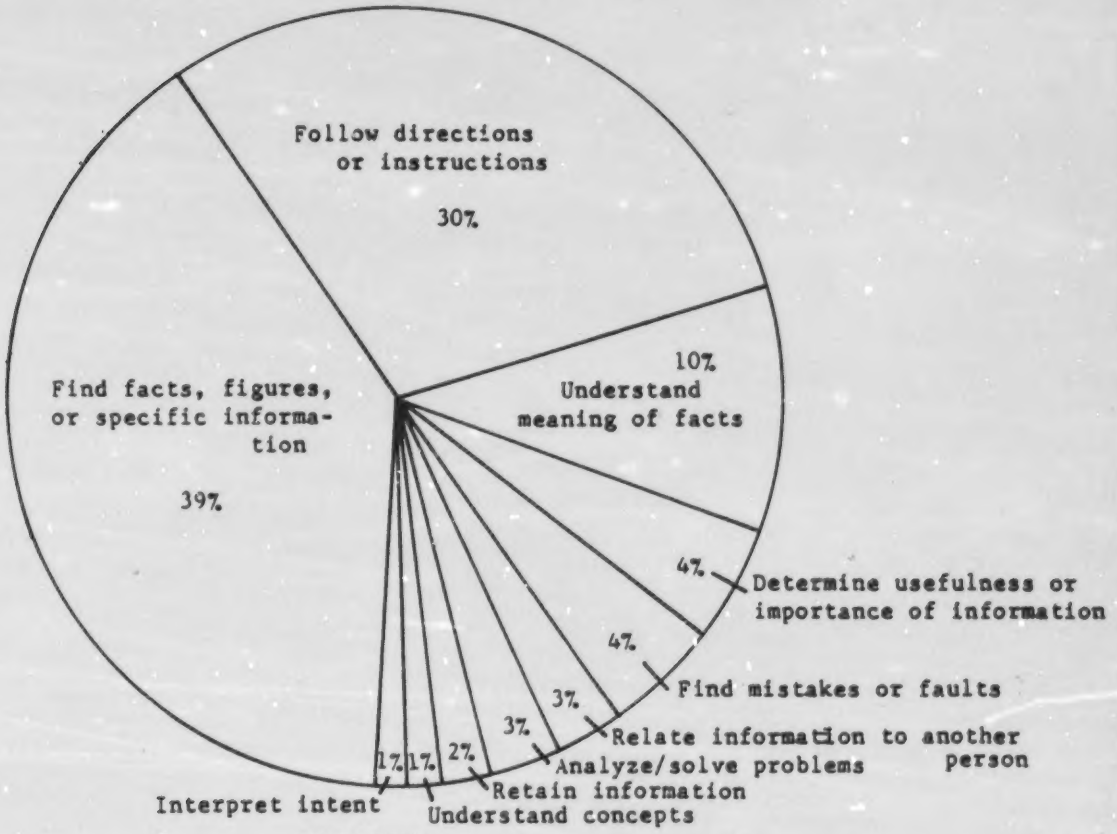


**Figure WR-1**

Reading to find facts, figures, or specific information were found to be the types of reading linked to most of the welding tasks. Together, they comprised 69% of all reading required (39% and 30%, respectively).

Understanding the meanings of facts accounted for only 10% of all job-related reading tasks performed by welders.

A total of 18% of the reading done by welders was divided among the following reading tasks: Read to determine the usefulness or importance of information (4%); Read to find mistakes or faults (4%); Read to relate information to another person (3%); Read to analyze or solve problems (3%); Read to retain information (2%); Read to understand concepts (1%); and Read to interpret intent (1%).

*Percentages were rounded off

WELDER READING TASKS
ANALYZED ACCORDING TO DUTY CATEGORY

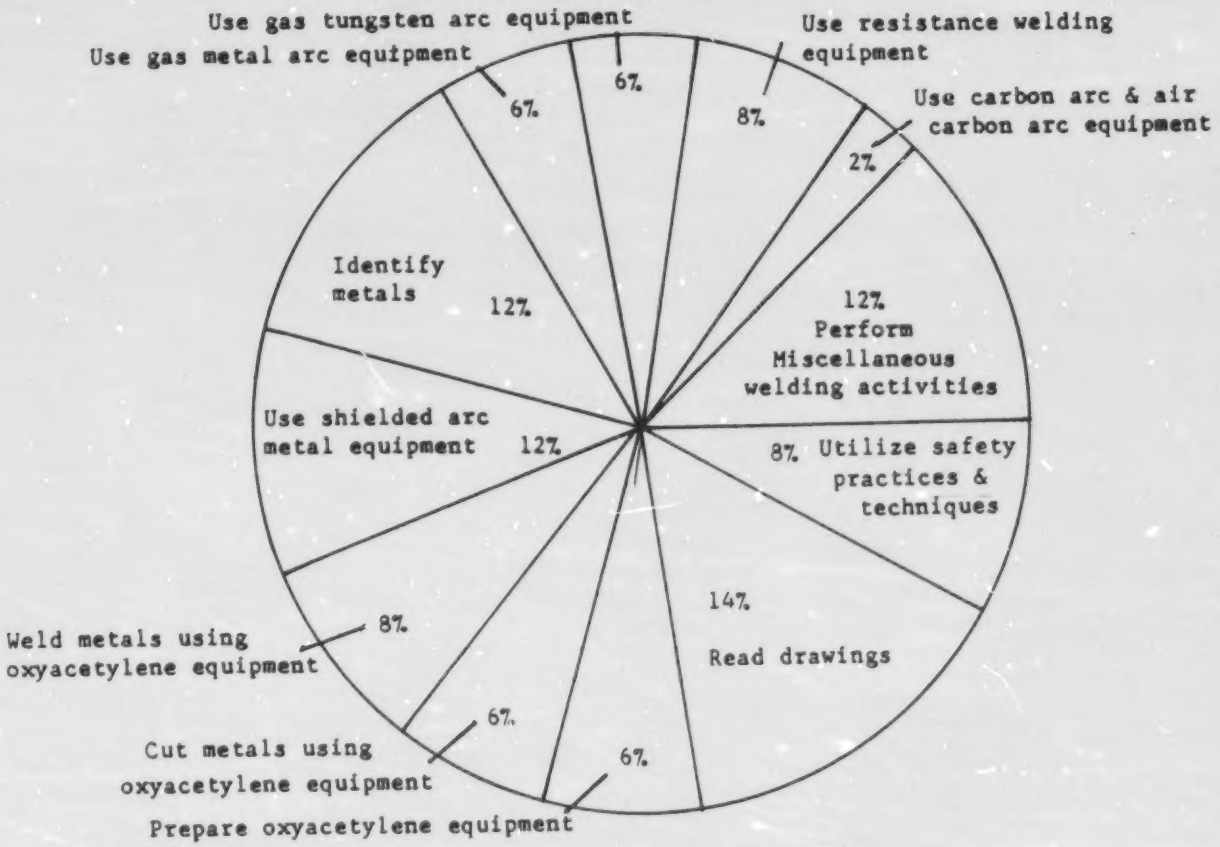


**Figure WR-2**

According to data provided by respondents to the survey, one-half of the tasks requiring reading fell into the following categories: Read drawings (14%); Using shielded mental arc equipment (12%); Identify metals (12%); and Perform miscellaneous welding activities, such as operating cutting and grinding machinery (12%).

Almost one-fourth (24%) of the reading tasks performed by welders were associated with Utilizing safety practices and techniques (8%), Welding metals using oxyacetylene equipment (8%), and Using resistance welding equipment (8%).

Another 24% of the reading tasks required of welders were associated with Preparing oxyacetylene equipment (6%), Using gas metal arc equipment (6%), and Using tungsten arc equipment (6%).

The remaining 2% of all reading tasks fell into the category of Using carbon arc and air carbon arc equipment.

WELDER TASKS
LINKED TO SPECIFIC APPLICATIONS OF
JOB-RELATED READING

In order to illustrate how reading is applied on the job, the following chart gives some examples of job-related reading performed by clerk-typists in each duty category:

| EXAMPLES OF SPECIFIC APPLICATIONS OF JOB-RELATED READING |
|---|
| Read pressures on guage |
| Read and follow written instructions for set-up |
| Read and interpret blueprints, sketches and specifications and layout materials |
| Read preheat and postheat temperatures as noted in written material |
| Refer to tip manufacturer's charts for correct pressure |
| Read equipment manuals |
| Read measuring tape scale |
| Read safety manuals |
| Read written work orders--if unclear, ask for help |
| Read dials on equipment |
| Read meters |
| Read cleaning specifications to clean metal |
| Read welding symbols |
| Read views and lines |
| Read safety and warning signs posted in shop |
| Read a time clock |

## OCCUPATIONALLY SPECIFIC AND GENERAL INSTRUCTIONAL MATERIALS FOR TEACHING JOB-RELATED READING

Basic Skills in Reading series
Cebco Standard Publishing, 1980.
Understanding instructions
Understanding forms
Understanding announcements and messages
Understanding travel information

Basic Vocabulary Builder, Erlich & Murphy
McGraw-Hill Book Co., 1975.
Alphabetical listing of general vocabulary words including: pronunciations, definitions, derivations, examples

Bluepring Reading Series Delmar Publishers, 1970.
Programmed in the following titles:
Introductions
Dimensioning
Views
Sections
Fractions

Blueprint Reading for Welders A. E. Bernett & Louin J. Siy
Delmar Publishers, 1978.
Basic lines, views, dimensions, notes and specifications, Structural shapes, sections, detail and assembly drawings

Career Communications series, Brown
Bobbs-Merrill Publishing, 1980.
Reading, writing, and speaking as used in career-related courses

Content Area Reading Skills: Reference
EDL/McGraw Hill, 1978.
Levels C through I
Includes curricula such as: Using a table of contents, using alphabetical order, reading maps, using a diagram, using aglossary, using a dictionary to find meanings of words, using an index, using a pronunciation key, using a bibliography, using parts of a book, etc.

Essential Skills series
Jamestown Publishes, 1976.
Books 1 through 20
Comprehension categories include: subject matter, main idea, supporting details, conclusions, clarifying devices, vocabulary in context

Everyday Reading and Writing Laubach, Kirk and Laubach
New Readers Press, 1979.
General context--signs, newspapers, personal letters, dictionary, library, maps, instructions, safety, etc.

From Pictures to Passages, Evanson
Contemporary Books, Inc., 1978.
Includes sections of following directions, drawing conclusions, finding the main idea and supporting details, following sequences, etc.

On The Job, Wm. O'Rourke, ed.
Vintage Books, 1977.
An anthology of fiction containing stories about working in America

Pocket Welding Guide
Hobart School of Welding Technology , Fray, Ohio.
Reference manual related to welding processes.

Pre-GED Basic Skills Series of Basic Reading Skills, Aliyah Abdul Karim McGraw-Hill Book Company, 1981.
GED preparatory reading. Includes areas such as following directions, finding information in the library, finding a job, etc.

Reading By Doing, Simmons & Palmer
National Textbook Company, 1981
Includes finding facts and details, establishing order or sequence, finding expressed main ideas, finding metaphoric meaning, reading for implied main ideas.

Reading Competence, Royce & Reiter
Cambridge Book Company, 1977.
Based upon general reading performance objectives.

Reading IV, A Teacher Duplicator Master Book
VMI Basic Skills & Concepts Library, 1973.
Based upon general reading performance objectives.

Read to Succeed, Bracy & McClintock
McGraw-Hill, Book Company, 1980/
Word attack & spelling akills, dictionary skills, comprehension skills, vocabulary skills, and study skills

Real Life Reading and Writing on the Job
Scholastic Books, 1980.
self-paced instruction

OCCUPATIONALLY SPECIFIC AND GENERAL INSTRUCTIONAL MATERIALS
FOR TEACHING JOB-RELATED READING

Real Stories series, Katz, Chakeres, & Bromberg
Glove Book Company, 1975.
Stories adapted from newspaper and magazine articles for low-level readers

Safety and Health for Technical Education an instructor resource guide Center for Occupational Research & Development, Waco, Texas, 1981.
Ocupationally specific modules to read by students or taught by instructors

Solving Life Problems in Occupational Knowlege, Cook
McGraw-Hill, 1980.
Levels 1, 2, & 3 (Job-related general)

Specific Skills Series
Barnell-Loft, Ltd., 1976.
Levels C through I
Working with sounds, following directions, using the context, locating the answer, getting the facts, drawing conclusions, getting the main idea, detecting sequence

Strategies for Reading, Robinson, Anderson, Hittleman, Patterson, & Paulsen, Allyn & Bacon, Inc., 1978.
Strategies for reading sentences, words in context, paragraphs, and long selections.

Symbols for Welding Hobart School of Welding Technology, 1976.
Programmed instruction

Welding Terms Rolt Hammond, Alvin Redman Limited, 1964.
Welding terminology in alphabetical order translated into: English, French, German, Spanish, and Italian
Diagrams and plates are included to illustrate some of the terms

Write and Read series, Dawkins
EDL/McGraw-Hill
Combines reading directions and following them by writing

Working With Words, Putnam
Steck-Vaughn, 1980.
Letter, word, and sentence patterns

# Job-Related Writing

## Related Terminology

| | |
|---|---|
| Basic writing skills: (occupationally oriented) | Essential writing skills needed to secure and maintain employment. |
| Writing taxonomy: | Classification system which identifies a hierarchy of writing skills stated in performance terms. |
| Job-related writing tasks: | Writing tasks performed in conjunction with occupational tasks. |
| Welder (combination): | A worker who welds metal components together to fabricate or repair products, such as machine parts, plant equipment, mobile homes, motors, & generators, according to layouts, blueprints, or work orders, using brazing & a variety of arc and gas welding equipment. |
| Entry-level welder: | A person entering the occupation of welder. |
| Occupation: | The overall category into which particular duties are categorized. |
| Duty: | A major category of work which consists of related tasks performed by welders. |
| Task: | A measurable element of work usually performed by a single worker in a short span of time. Tasks are grouped into duty areas. |
| Welder task list: | A listing of the identified tasks performed by welders. |
| Competency: | The demonstrated ability to perform specific tasks. |

## Job-Related Writing

The ability to convey a message in writing is required in varying degrees on the job. For most workers, job-related writing consists of completing forms or writing brief notes. This may seem minimal; however, according to 1980 report by Mikulecky and Deihl, 65% of all job-related writing is performed daily.[19]

Legible handwriting, correct spelling, proper punctuation, and correct English usage require the knowledge of some basic writing skills that can be categorized into three areas: Mechanics, usage, and composition. Each category includes some specific skills which must be mastered in order to express facts or ideas in writing. These skills are outlined below:

Writing skills

1. Mechanics
   alphabetization, penmanship, spelling, capitalization, and punctuation
2. Usage
   standard English grammar and diction
3. Composition
   phrases, sentences, paragraphs, passages

Written communication may be a necessary component of an occupational task, or it may be the task itself. For instance, writing a memo is both an occupational task and a writing task. All job-related writing consists of applying writing skills to job-tasks.

A taxonomy which takes a job-related approach to basic writing skills and expresses them in performance terms is listed on the following page. Correlated with the taxonomy are the three main categories of writing (mechanics, usage, and composition.)

---

[19]Mikulecky, L. and W. Diehl, Job Literacy: A study of Literacy Demands, Attitudes, and Strategies in a Cross-Section of Occupations. Bloomington, Indiana: The Reading Research Center, 1980.

| Job-related writing task[20] | Writing skill |
|---|---|
| Write to: | |
| form numbers and letters | 1. Mechanics |
| produce legible material | Mechanics |
| spell correctly | Mechanics |
| capitalize appropriately | Mechanics |
| punctuate properly | Mechanics |
| use correct grammar and diction | 2. Usage |
| compose phrases | 3. Compositon |
| compose complete sentences | Composition |
| organize and compose paragraphs | Composition |
| create memos, letters, & reports | Composition |

## DISCUSSION OF THE DATA

Of the 174 occupational tasks listed in the welder survey, preliminary results indicated that only 7% of those tasks required some type of writing.

Figure WW-1 presents a percentage breakdown of each type of writing involved in the performance of welder tasks.

Figure WW-2 presents a percentage breakdown of writing required in each of the duty categories for the occupation of entry-level welders.

The figures are located on the following pages.

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[20]Mickulecky, L. and W. Diehl, op. cit.

WELDER WRITING TASKS ANALYZED
ACCORDING TO PERCENTAGES OF EACH TYPE OF WRITING REQUIRED*

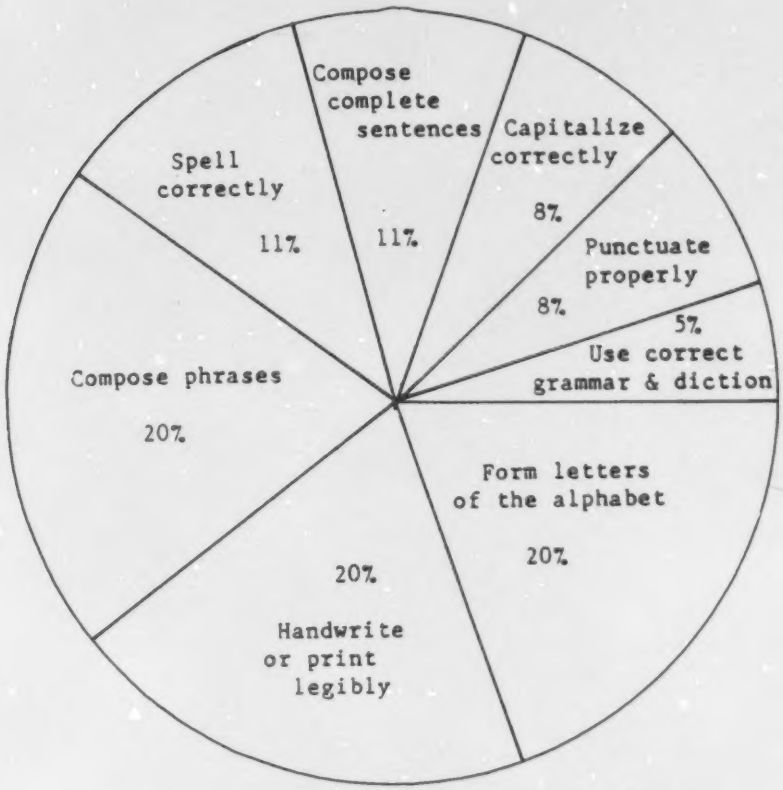


**Figure WW-1**

Writing to form numbers and letters of the alphabet, writing or printing legibly, and composing phrases were equally necessary for welder task performance. (Each type of writing comprised 20% of all job-related writing).

Spelling and composing sentences each made up 11% of the writing tasks performed by entry-level welders.

Over 80% of the writing done on the job was accounted for in aforementioned types of writing tasks. The remaining 21% included: Capitalization (8%), Punctuation (8%), and Using correct grammar & diction (5%).

The advisory group reported that an entry-level welder never needs to compose paragraphs or write memos, letters, articles and reports (two categories of writing tasks included in the taxonomy).



*Percentages were rounded off.

WELDER WRITING TASKS
ANALYZED ACCORDING TO DUTY CATEGORY

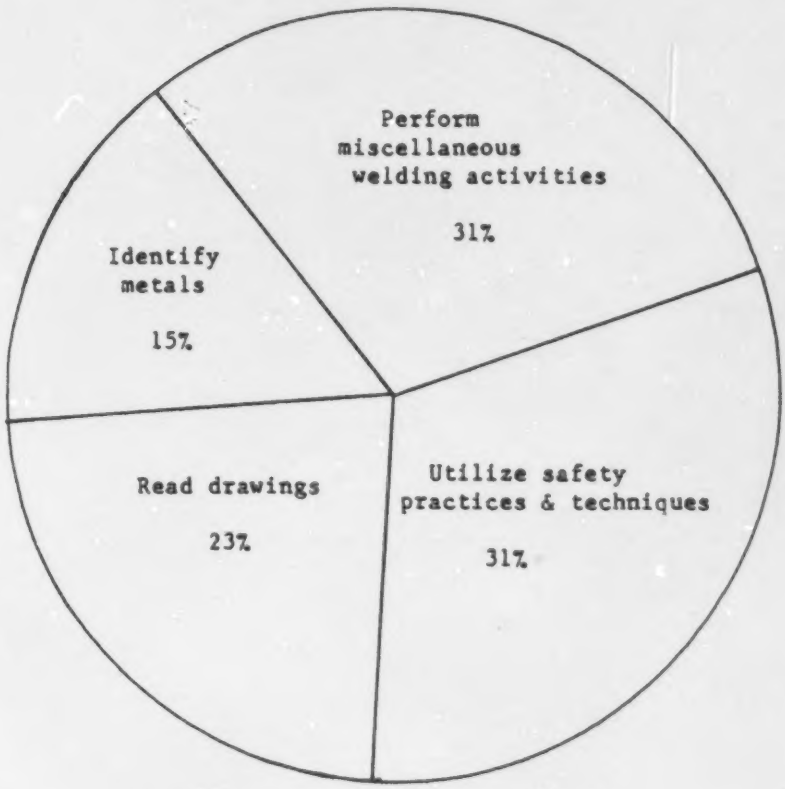


**Figure WW-2**

According to preliminary data provided by respondents, only four of the twelve duty categories were linked to the performance of writing tasks. Almost one-third (31%) of the writing tasks performed by welders fell into the duty category of Utilizing safety practices and techniques. Another 31% fell into the category of Performing miscellaneous welding activities. Reading drawings accounted for 23% of the writing done on the job, and Identifying metals, 15%.

WELDER TASKS
LINKED TO SPECIFIC APPLICATIONS
OF JOB-RELATED WRITING

In order to illustrate how writing is applied on the job, the following chart gives some examples of job-related writing peformed by welders.

| EXAMPLES OF SPECIFIC APPLICATIONS OF JOB-RELATED WRITING |
| --- |
| Complete report form on an accident |
| Label material with a paint stick |
| Complete labor voucher neatly |
| Complete a work order form |
| Write a materials list |
| Fill out a time card |
| Fill out a job application properly |

OCCUPATIONALLY SPECIFIC AND GENERAL INSTRUCTIONAL MATERIALS
FOR TEACHING JOB-RELATED WRITING

Applied Penmanship, Ferguson & Lyon
South-Western Publishing, 1980.
Legibility.

Building Basic Skills in Writing , Books 1 and 2, Rob Sax
Contemporary Books Inc.
Peterson Handwriting, 1978.
Legibility (general vocational).

Language Skill Books,
Steck-Vaughn Company, 1978.
Book 610: Capitalization, punctuation, sentences.
Book 830: Usage
Book 720: Usage (nouns, pronouns, verbs).
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DA-Usage, Sentences
EA-Usage, Punctuation, sentences, letters
FA-Usage, Capitalization, punctuation, sentences, paragraphs.

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## Appendix A
## Sample Request for Information

# Salt Lake Skills Center

*A Division of Utah Technical College*

The Utah State Office of Labor and Training, through Utah Technical College, is currently involved in a project which relates specifically to basic skills requirements for entry level workers in five occupations--Secretary, Carpenter, Welder, Electronic Technician, and Retail Merchandiser.

The main objective of this project is to determine the basic skills (or competencies) required for each specific occupations mentioned above. Another objective is to locate curricula which attempts to teach those skills. We are also interested in pre and post assessments which measure a student's skills before and after instruction.

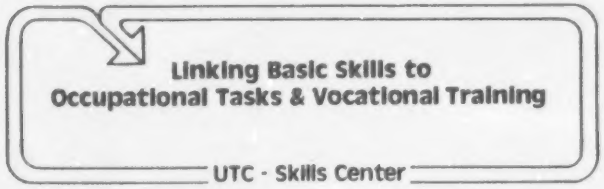
We are interested in any information your institution may provide--competency lists, instructional materials, and/or assessments. We would appreciate any knowledge, assistance, and/or contributions which may be helpful to us in this endeavor. If you are able to assist us before August 15th, we would be most grateful.

A manual, describing the basic skills (math, reading, communication skills) required to perform specific occupational tasks, and a list of instructional materials which teach those skills will be available upon request October 1, 1981.

Sincerely yours,

Marj Bradley
Project Coordinator
Utah Technical College
Skills Center
431 South 600 East
Salt Lake City, Utah 84102
(801) 531-9337
531-9347

**Appendix B**
**Sample of Welders Survey Form**




A SURVEY OF JOB-RELATED BASIC SKILLS REQUIRED FOR WELDERS

| OCCUPATIONAL TASKS | FREQUENCY | | | | EQUIPMENT, MATERIALS, JOB AIDS, MACHINERY, TOOLS, ETC. | JOB-RELATED BASIC SKILLS |
|---|---|---|---|---|---|---|
| | Dly | Wkly | Less oftn | Nevr | | |
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## Appendix C
## Basic Skills Taxonomies

## LISTENING/SPEAKING KEYS

### JOB-RELATED LISTENING TASKS

LISTEN TO:

- Suggestions
- Referrals
- Facts
- Criticism
- Instructions
- Other (specify on questionnaire)

LISTEN TO JOB QUESTIONS

LISTEN TO FACTUAL PRESENTATION IN A GROUP

LISTEN EVALUATIVELY TO A PERSUASIVE TALK

LISTEN TO ON-THE-JOB DEMONSTRATIONS

### JOB-RELATED SPEAKING TASKS

GIVE:

- Suggestions
- Referrals
- Facts
- Criticism
- Instructions
- Other (specify on questionnaire)

ASK JOB QUESTIONS

GIVE FACTS IN A GROUP DISCUSSION

PARTICIPATE IN AN INTERVIEW

GIVE AN ON-THE-JOB DEMONSTRATION

PURSUADE:

- One person
- One group

USE NON-VERBAL LANGUAGE

## MATHEMATICS KEY

### JOB-RELATED MATH TASKS

1. COUNT OR PUT IN ORDER

   A. Whole Numbers
   B. Fractions
   C. Mixed Numbers
   D. Decimals other than money
   E. Money
   F. Percents
   G. Dates
   H. Time

2. COMPUTE (ADD, SUBTRACT, MULTIPLY, OR DIVIDE)

   A. Whole Numbers
   B. Fractions
   C. Mixed Numbers
   D. Decimals other than money
   E. Money
   F. Percents
   G. Distance of lines
   H. Area
   I. Volume
   J. Weight
   K. Force
   L. Time
   M. Rate (Speed)
   N. Temperature
   O. Cost
   P. Ratio
   Q. Proportion

3. MEASURE WITH STANDARD MEASURES (ENGLISH SYSTEM)

   A. Measures of distance
   B. Weight (ounces, lbs., etc.)
   C. Temperature (Farenheit)
   D. Capacity (pints, qts., etc.)

4. ESTIMATE WITH STANDARD MEASURES
   A. Measures of distance
   B. Weight (ounces, lbs., etc.)
   C. Temperature (Farenheit)
   D. Capacity (pints, qts., etc.)

5. CHANGE FROM ONE SYSTEM OF MEASUREMENT TO ANOTHER

   A. Percent to Fractions
   B. Fractions to Decimals
   C. Decimals to Percent
   D. English to Metric (Distance, Weight, Capacity)
   E. Temperature (Farenheit to Celsius)

6. UNDERSTAND AND CONSTRUCT VISUAL PRESENTATIONS OF NUMBERS

   A. Graphs
   B. Schedules
   C. Tables
   D. Scales
   E. Charts

7. WORD PROBLEMS

   A. Solve word problems
   B. Use specific formulas

8. SOLVE ALGEBRA PROBLEMS

   A. With letters as symbols
   B. Use specific formulas

9. USE FORMULAS TO EXAMINE GEOMETRIC FORMS AND SHAPES

   A. Flat Shapes
   B. Three-Dimensional Forms

10. INTERPRET OR CONSTRUCT DRAWINGS

   A. Scale Drawings
   B. Assembly Drawings
   C. Schematic Drawings
   D. Shop Drawings

## READING/WRITING KEYS

### JOB-RELATED READING TASKS

Read to find facts, figures, or specific information

Read to follow directions or instructions

Read to understand meaning of facts

Read to retain (remember) information

Read to determine the importance or usefulness of information

Read to relate information to another person

Read to find mistakes or faults

Read to analyze or solve problems

Read to understand concepts (concrete/abstract)

Read to interpret intent

### JOB-RELATED WRITING TASKS

Form letters of the alphabet

Write or print legibly

Spell correctly

Capitalize appropriately

Punctuate properly

Use correct grammar and diction

Compose phrases

Compose complete sentences

Organize and compose paragraphs

Create memos, letters, articles, or reports

## Appendix D
## Sample of Basic Skills Linkage Data

The information on the following page was compiled from advisory group responses to the survey. Each member was asked to respond to the need for specific basic skills tasks in performing welder tasks.

Respondents were asked to consider each occupational task as a performance in itself--isolated from any preparation or follow-up activities. The data is preliminary and subject to respondents' individual interpretations of the task statement.

| OCCUPATIONAL TASK | JOB-RELATED BASIC SKILLS | | | | |
|---|---|---|---|---|---|
| | LISTENING | SPEAKING | MATHEMATICS | READING | WRITING |
| USE GAS TUNGSTEN ARC EQUIPMENT | | | | | |
| Check work conditions for safety. | Listen to:<br>-criticism<br>-instructions<br>-on-the-job demonstrations | Give suggestions<br>Ask job questions | none | none | none |
| Set up equipment | Listen to:<br>-criticism<br>-instructions<br>-on-the-job demonstrations | Give suggestions<br>Ask job questions | none | none | none |
| Adjust equipment | Listen to:<br>-criticism<br>-instructions<br>-on-the-job demonstrations | Give suggestions<br>Ask job questions | Count or put in order:<br>-whole numbers | none | none |
| Prepare metal surfaces | Listen to:<br>-criticism<br>-instructions<br>-on-the-job demonstrations | Give suggestions<br>Ask job questions | none | none | none |
| Run beads in all four positions | Listen to:<br>-criticism<br>-instructions<br>-on-the-job demonstrations | Give suggestions<br>Ask job questions | none | none | none |